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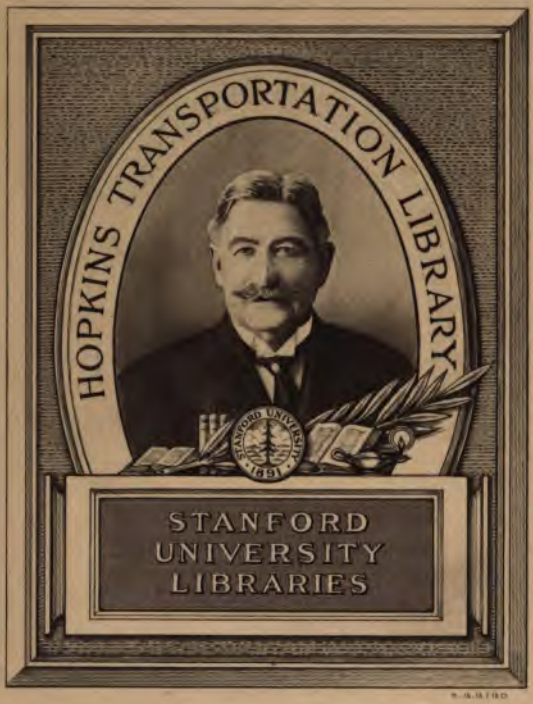
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NARRATIVE

OF

TWELVE YEARS' EXPERIMENTS,

(1824—1836,)

DEMONSTRATIVE

OF

THE PRACTICABILITY AND ADVANTAGE

OF EMPLOYING

STEAM-CARRIAGES

ON

COMMON ROADS:

WITH

Engravings and Descriptions

OF

THE DIFFERENT STEAM-CARRIAGES CONSTRUCTED BY THE AUTHOR, HIS PATENT BOILER, WEDGE-WHEELS, AND OTHER INVENTIONS.

[STEAM PHÆTON.]

BY WALTER HANCOCK, ENGINEER.

London:

PUBLISHED BY JOHN WEALE, ARCHITECTURAL LIBRARY, HIGH HOLBORN:

AND J. MANN, CORNHILL.

1838.

S S Plate 55

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*** At the moment of going to press, the writer has been informed that there are persons making attempts to improve both railway and common-road steamers, by adopting colorable imitations of his patent: should any ungenerous rival, however, so far degrade himself, the writer relies with confidence on the justice of the public. Whatever improvements may result from the mode of generating steam by means of flat chambers, exposing large thin sheets of water to the action of corresponding thin volumes of heated air, through flues formed by alternate chambers placed side by side—the writer claims this as the grand and principal feature of his invention; and should tortuous or colorable expedients to deprive him of the results of his long-continued and expensive exertions be attempted, he confidently hopes that the support of the public will in vain be sought in behalf of the authors of such proceedings.

INTRODUCTION.

THE last twelve years have produced a great revolution in popular opinion regarding the expediency of employing steam as a locomotive agent on common roads; and this chiefly through the persevering exertions of a few ardent individuals, unconnected with, and acting indeed in rivalry of each other, to demonstrate, experimentally, that it is at once the cheapest and most efficient agent that can be employed.

No doubt, the discussions which the subject has undergone in the public journals, and the Parliamentary inquiries of which it has been thought worthy, have helped to bring about this favourable change; but neither the warm advocacy of intelligent journalists, nor the deliberate recommendations of Select Parliamentary Committees, would have availed much, without those *ocular proofs* of the ease with which steam carriages can be employed on common roads, and of the many national benefits that would result from their universal adoption, which the practical men who have devoted their talents and energies to the business, have continued to furnish—day after day, and year after year—in spite of a thousand opposing difficulties—and under favour of the slenderest possible public encouragement.

Now that the public seem to have at last reached the point of taking up in good earnest this improvement in the means of internal communication—the "most important" in the opinion of the Select Parliamentary Committee of 1831, "that was ever introduced"*—it is but natural that those who have been the active instruments of its development, should be anxious to vindicate, each for himself, the share of praise which is his due. Neither, perhaps, is it more than what experience might lead us to expect, that those who have done the least, should make the most noise about their doings, and clamour most for public honours and rewards.

The author of these pages believes he should offend alike against truth and genuine modesty, were he to yield to any of the steam-carriage inventors who have appeared in his day, in a single particular of desert; he began earlier (with one abortive exception) and has persevered longer and more unceasingly than any of them; he was the first to run a steam carriage for hire on a common road, and is still the only person who has ventured in a steam vehicle to traverse the most crowded streets of the metropolis at the busiest periods of the day; he has built a greater number of steam carriages (if not better) than

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* "These inquiries have led the Committee to believe that the substitution of inanimate for animate power in draught on common roads, is one of the most important improvements in the means of internal communication ever introduced. Its practicability they consider to have been fully established; its general adoption will take place more or less rapidly in proportion as the attention of scientific men shall be drawn by public encouragement to further improvement."—*Report Select Parliamentary Committee of* 1831.

any one else, and has been thus enabled to try a greater variety of forms of construction, out of which to choose the best; and all that he has done, has been with his own means chiefly, while his rivals—the more prominent of them at least—have been largely assisted by others. He has never, however, been an obtrusive suitor for the favour of the public—neither pestered it with boastful pamphlets, nor with wild exaggerations; he has been all along more anxious that his works should speak for him, than he for them. His steam carriages running on the public roads, have been his best witnesses. He has been occasionally obliged to address the public journals, for the purpose of correcting erroneous statements that had gone abroad respecting particular performances of his carriages; but beyond that he has hitherto troubled the press but little.

Nor perhaps should he have been now inclined to depart from the quiet, yet earnest, course he has hitherto pursued, were it not that he sees himself in some danger of being thrust aside in public regard, through the extraordinary efforts made by others to arrogate to themselves all the praise, where they have at best had but a share of the merit.

That neither the public may be the dupes, nor he the victim of false pretensions, he has at length resolved on publishing a complete and faithful narrative of his steam carriage experiments from their commencement, twelve years ago to the present period, along with engravings and descriptions of all the carriages he has built, and of the particular mechanical improvements which have from time

to time been embodied therein, and have led to that perfect success, which his performances have so often and so publicly attested.

In making public these experiments, he must distinctly disclaim being actuated by any vindictive motives; he certainly feels none, and has but small cause to feel any; for much as his rivals have occupied the public attention with their vaunts, they have, as it happens, left him almost alone in the pursuit, and the field of locomotive enterprise as open as ever. His sole object is to do justice to himself, and justice to the cause in which he has been so long engaged, and the success of which he can never cease to have deeply at heart. He is anxious to make the whole truth known, in order that if it should be deemed expedient to promote, by any public grant, the general introduction of steam travelling on common roads, or to recompense in any way those who have been chiefly instrumental in advancing it thus far, the Government and the Legislature may have the means before them of judging, impartially, whose hands it would be best to strengthen for that purpose, and who, for their past exertions in this department of public improvement, have deserved most of their country.

Stratford, October, 1836.

NARRATIVE,

&c. &c.

THE attention of the author of this Narrative was first turned to the subject of steam locomotion on common roads, by the circumstance of his having invented, in 1824, a steam engine of a very novel description, which seemed to him peculiarly well adapted to the purpose. Metallic substances enter but in a very limited degree into the construction of this engine, and in the prime movers are almost entirely dispensed with; instead of iron or copper, an article is used which is not only much lighter, but free from all liability to fracture; and hence both a great reduction of weight and great capability of resisting tear and wear, two of the most important desiderata in a steam carriage intended for common roads. A front elevation of this engine is exhibited in Plate I. It has two flexible steam receivers (*f, f*), which are composed of several layers of canvas, firmly united together by coatings of dissolved caoutchouc or India rubber, and are thus enabled to resist a pressure of steam of sixty pounds upon the square inch. B is a four-way cock, which communicates with the steam receivers, and alter-

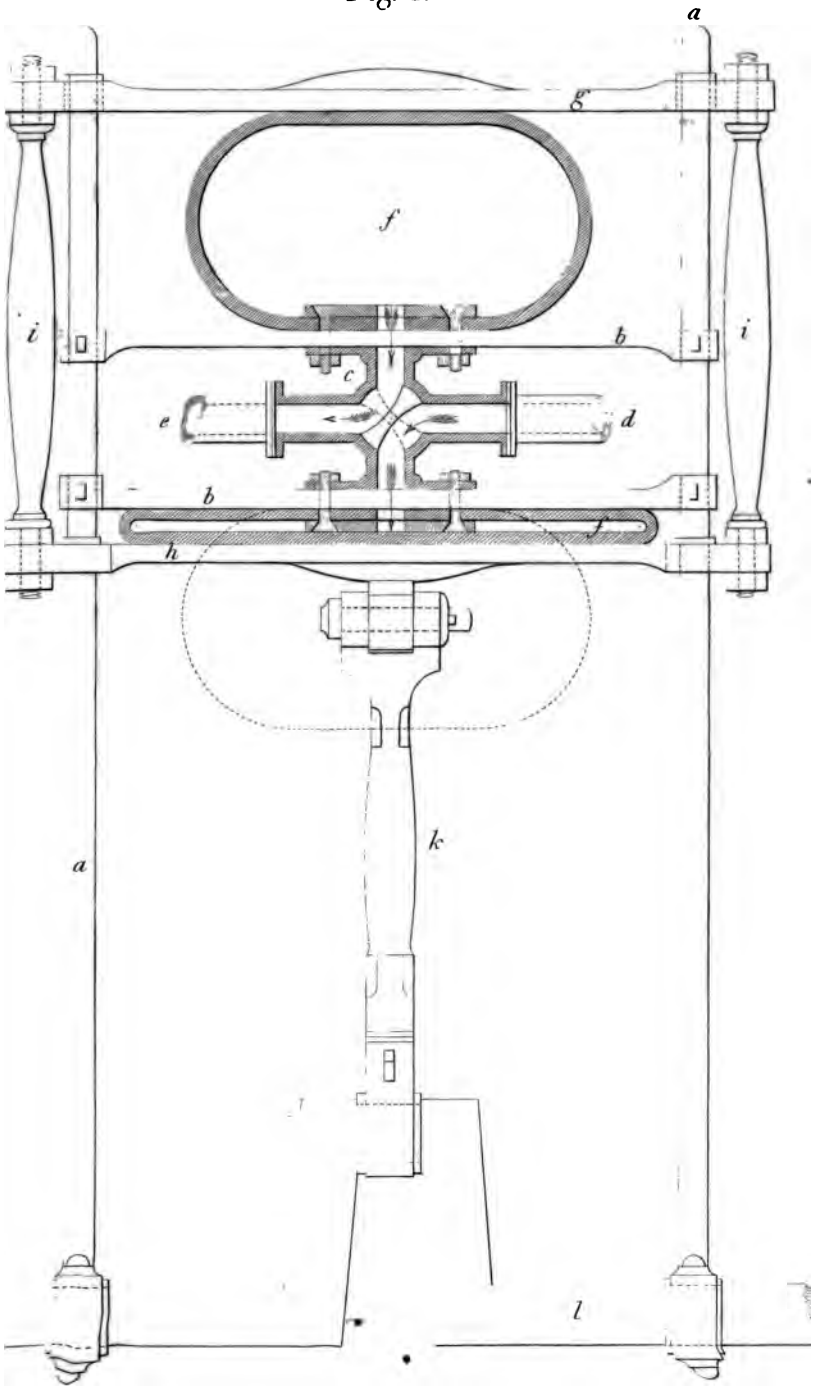
nately admits and shuts off the steam, as it is acted on by an eccentric moved by the engine. (The steam chambers and four-way cock are shown in section, that the communication may be more clearly seen): *a, a,* are two cylindrical guide rods, firmly secured at bottom to a timber-framing *C,* (not seen in the plate); *b, b,* stationary bearers or beds fixed to the rods, to which bearers the flexible receivers are firmly attached, the one superiorly, the other inferiorly; *g,* and *h,* two moveable plates, to which the receivers are also united, which pass freely up and down the guide rods *a, a; d,* the steam pipe from the boiler, through which the steam enters the flexible receivers; *e,* exit steam pipe (both *d,* and *e,* are attached to the same cock); *i, i,* are connexions between the plates *g,* and *h,* at each side; *k,* the crank rod, fastened by a free joint to the inferior moveable plate *h; l,* the crank shaft carrying a fly wheel (not shown in the engraving).

In the engine as represented in the plate, the upper receiver is filled with steam, and consequently at its extreme point of expansion, immediately previous to the exit of the steam by the pipe *e,* and the lower one is in a state of perfect collapse, but on the point of receiving steam from the pipe *d,* as intimated by the direction of the arrows. As the one receiver becomes emptied, the other is filled, and so on.

The dotted lines show the positions which the chambers and moveable plates alternately assume.

A regular reciprocating motion is thus obtained by the

Fig. 1.



alternate filling and discharging of the receivers, and is converted into a rotary motion by a crank in the usual way. An engine on this construction, of four-horse power, has been employed, at the author's manufactory at Stratford, for some time, and worked most satisfactorily. Its simplicity, comparative cheapness, and diminished friction (pistons, &c., forming no part of it), are its principal recommendations.

Anterior to the invention of this simple application of steam as a motive power, the writer had casually met with a print of a steamcarriage, built by Messrs. Bramah for a Mr. Griffiths; and it now occurred to him that his new engine was well adapted to sustain the concussions to which such a machine must necessarily be exposed. A model of a steam carriage on this plan he accordingly constructed, which so far bore out his previous conception, as to determine him to commence the building of one on a larger scale. But after many trials and experiments, he found that the requisite degree of power for locomotive purposes could not be attained by means of his new engine.

When once the mind, however, has been much exercised towards a certain point, it is no easy matter to apply it in a different direction; at least, it proved so in this case. Although his experiments demonstrated the inefficiency of his new engine as a locomotive agent, they left on his mind a strong conviction, that the application of steam power to the propulsion of carriages on common roads

was decidedly a practical object. The great and essential desideratum seemed to him to be—a boiler that while it should generate steam rapidly, and produce a sufficient and continuous supply, should occupy but little space, be of small weight (comparatively speaking), harmless if it should burst, simple in its construction, and inexpensive in its manufacture; to construct such a boiler became now, therefore, his chief study. The first result, after many tryings and changings, was a boiler of the construction represented in Plate II. This boiler consisted of sixteen *horizontal* tubes or pipes, each connected by lesser tubes with those immediately above it and on either side, so that the contained water or steam might circulate through the entire series of tubes. The large horizontal tubes were each four and a half inches in diameter, clear of the metal, and four feet long, arranged as shown in fig. 2. of Plate II., where *a*, *a*, *a*, represent the ends of the horizontal tubes, and *b*, *b*, the smaller connecting tubes; *c*, is a steam box or chamber, to prevent any water that might be driven out of the tubes along with the steam from entering through the exit pipe into the cylinder; *d*, is the safety valve; *e*, pipe for supplying and replenishing the boiler; *f*, steam exit pipe; *p*, *p*, pipes which convey the steam from the boiler, first into the steam box or chamber *c*, and then to the working cylinder; *g*, one of the lower horizontal tubes which conveys the water carried up by the force of the steam back into the boiler.

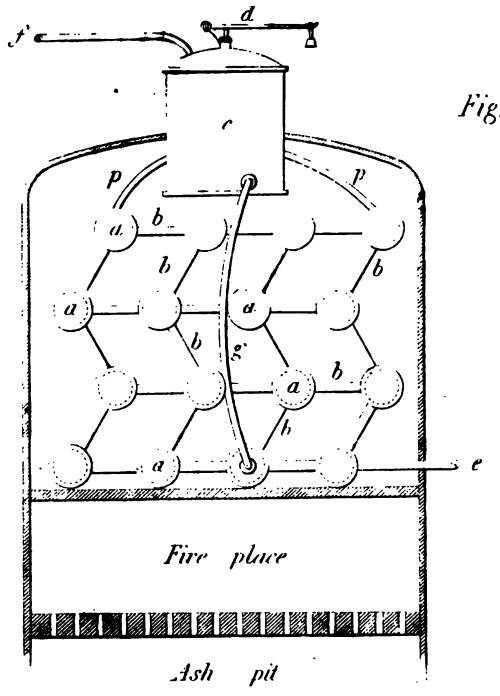


Fig: 2.

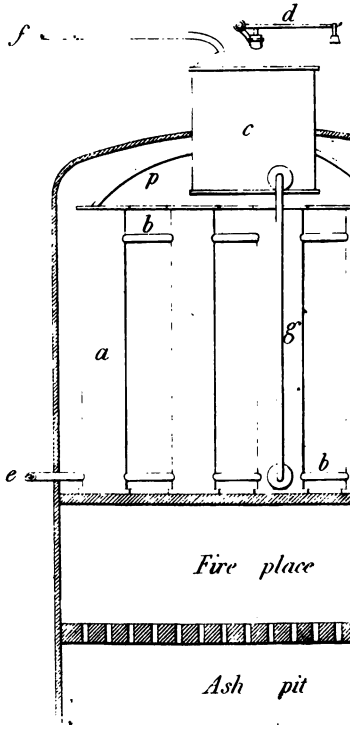


Fig: 3.

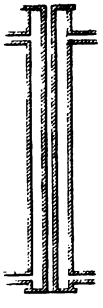


Fig: 4.

For the particular kind of tubes of which this boiler was constructed, the writer obtained a patent in 1825.

The reader will not fail to perceive that by this arrangement a very extensive surface is exposed to the influence of the fire, while a perfect circulation of the water within the tubes is established throughout the entire series; and consequently, that a very rapid generation of steam must be the result. The steam-box appendage, however, the writer considered to be extremely objectionable, both on account of the considerable space which it occupied, and of its lessening that security from explosion, which the employment of numerous tubes of small dimensions seemed to promise. The effect of a similar arrangement of tubes, but disposed *vertically*, was, therefore, next tried, as shown in fig. 3, Plate II.

This change in the position of the tubes was found to accelerate the generation and separation of steam, but there was still water enough forced out of the tubes along with the steam to make it impossible to dispense with the steam box. To get rid of this dangerous and inconvenient adjunct, now formed the chief object of the writer's attention. Many fruitless endeavours to accomplish this end followed in quick succession. One device better worth notice, perhaps, than the others, consisted in enlarging the heating surface, by passing a flue, two inches in diameter, up the centre of each of the four and a half inch generating tubes, as shown in fig. 4, Plate II., where two sections, one vertical, the other transverse, are given

of one of these tubes. The quantity of steam generated in a given time was much increased by this means, but the multiplication of the parts was objectionable, as rendering their connexion both complicated and expensive; the number of joints and rivets afforded, moreover, but little security in regard to leakage.

The unsatisfactory result of every attempt to produce a safe and efficient boiler, on the tubular principle, led the writer to consider of some arrangement by which the water, exposed to the action of the fire, might be less divided, and yet extended over a large surface; and the plan now occurred to him, which he has since successfully followed in the several steam carriages he has built, and applicable also to a variety of other purposes. For this invention, which he has denominated the chamber boiler, he obtained a patent in 1827.

This boiler (of which a front view is given at fig. 5, and plan at fig. 6, Plate III.) possesses all the advantages which the writer had sought for in tubular boilers, without their defects. The front view, fig. 5, it will be observed, is partly shown in section, to give a better idea of the internal construction; the shaded part from the bottom, more than half way up, represents the usual proportion of water under the process of evaporation.

This boiler is composed of a series of distinct thin parallel chambers, or compartments, *c c*, placed side by side in a vertical position: all these chambers are of one width, extending across the whole breadth of the fire-

Fig: 5.

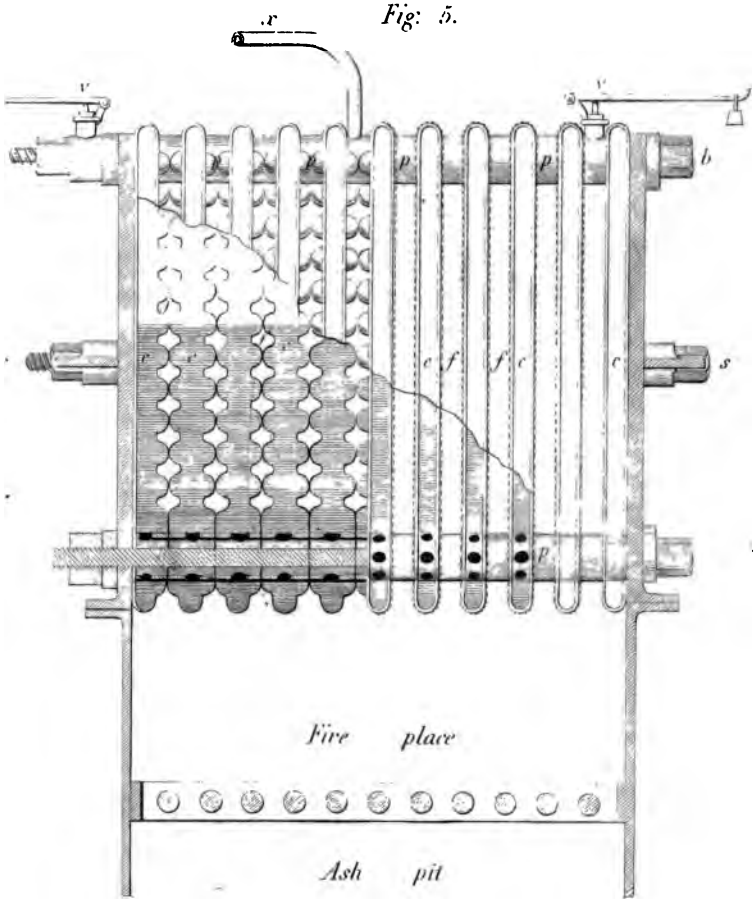
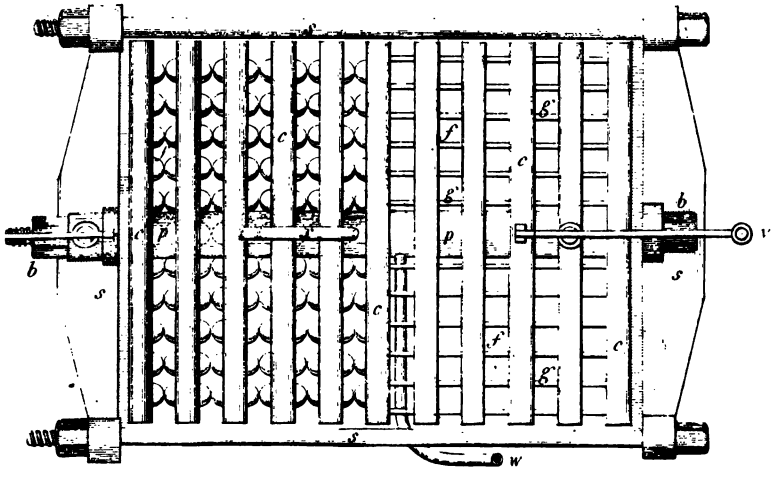


Fig: 6.



place beneath them, with sufficient spaces, *ff*, between the chambers for the play of the fire upwards.

The chambers are connected throughout, near to the top and bottom, as shown at *p p*; and each chamber is prevented from distending, and thereby choking up the fire-ways or flues, by vertical bars *g g*, as shown on the right-hand half of the boiler, or by hemispherical or other formed embossings or projections, made on the sides of the chambers, and meeting each other in juxta-position, as shown on the left-hand half of the boiler, in figs. 5 and 6.

A boiler constructed on the embossed plan is lighter, and a greater surface is obtained than in one in which divisional bars are used.

About four or five years ago, the writer tried various forms of projection in the sides of the chambers; some of them were channelled or corrugated the whole length, so as to form straight flues, and others were of irregular forms, to cause the heated air in its ascent to impinge on their lower surfaces, with a variety of other similar contrivances; but after giving the best consideration to all the forms, he was upon the whole induced to adhere to the hemispherical embossing, conceiving that form to possess the greatest advantages, although he is still of opinion, that the use of vertical bars to prevent the distension of the chambers, and to form the flues, will have advantages in some cases, and may hereafter be recurred to.

The hemispherical projections on the sides of the chambers the writer has occasionally employed almost from the

first; but the corrugated form was suggested to him accidentally, in a boiler composed of plain-sided chambers, with vertical bars between, which (through inattention to the due supply of water,) being allowed to get almost red hot, instead of maintaining the shape shown in the horizontal section of two chambers at fig. 1, Plate IV., the metal became so yielding by the heat, that the internal pressure caused them to assume the form shown at fig. 2: by simply taking out the bars, and bringing the protruded parts in contact, the open spaces would, of course, allow a sufficient passage for the fire upwards, without the divisional bars or gratings *g g*: such is the arrangement of two chambers shown at fig. 3.

A view of part of one of these corrugated chambers is shown at fig. 4, and a similar view of a chamber hemispherically embossed at fig. 5, same plate; in each of which the perforated rings, through which the bolts *b* pass, may be observed, one of which rings is shown more clearly at fig. 6.

Fig. 7, is a horizontal section, corresponding with the plan, fig. 6, Plate III., the darkly-shaded parts showing the interior of the chambers.

The whole boiler (whatever the form of chamber) is braced together by bolts *b b*, and stays *s s*, figs. 5 and 6, Plate III., and fig. 7, Plate IV.

v v, the safety valves; *w*, the feed-pipe conveying in water; *x*, the steam exit-pipe.

The connexions *p p*, through which the bolts pass, have

Fig. 4.

Fig. 1.

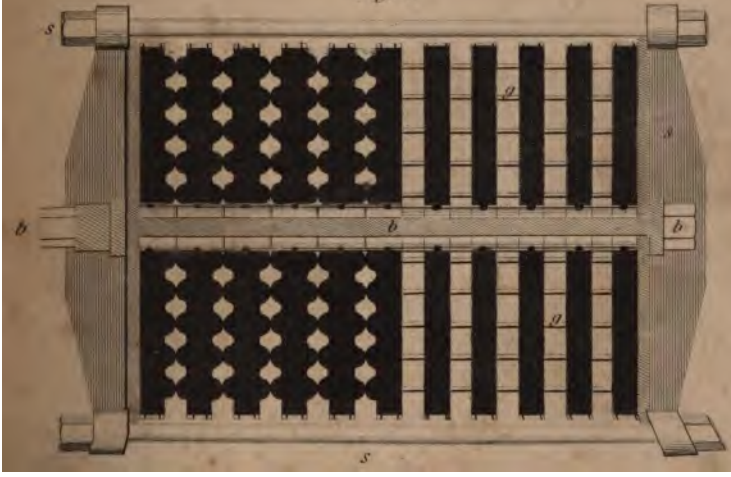
Fig. 2.

Fig. 5.

Fig. 3.

Fig. 6.

Fig. 7.



been named; but it may be proper to observe, that such connexion is composed of a series of rings so much larger than the bolts *b b*, as to allow steam in the top, or water in the bottom line of connexion, to pass freely from one side of the boiler to the other, through the perforated rings (shown at fig. 6, Plate IV.), one of which is contained in each chamber, at each bolt or line of connexion; and where the gratings *g g* are used, a ring of equal diameter, but imperforated, is also used between each chamber.

The form of these chambers, and the immediate connexion of them with each other, are such as to ensure an equal height of water throughout the series, by the perfect and uninterrupted range or flow of both water and steam through the openings provided for the bolts; the steam is rapidly generated, and there is no tendency in the water to rise above its average level, and, thereby mixing with the steam, escape with it; therefore, to this boiler no separator is either required or used, nor is there any vessel besides the chambers to contain steam, so that any dangerous accumulation of it is impossible.

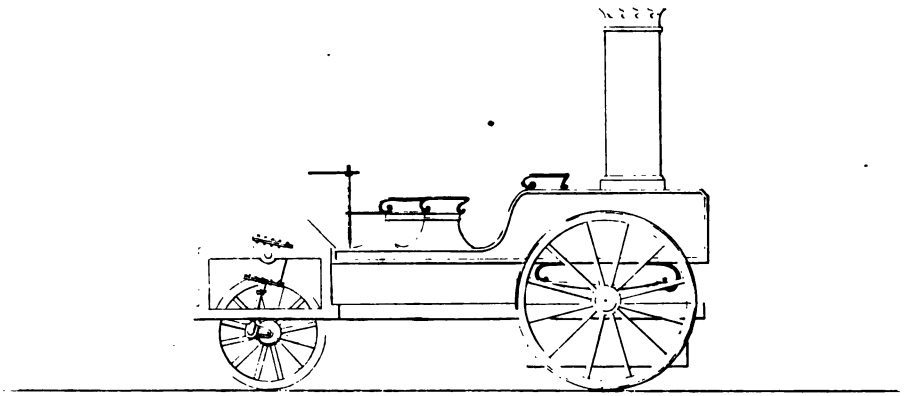
The perfect safety of this boiler arises from the ample subdivision of its parts and power, and the weakness of the chambers, as compared with the bolts and braces by which the whole series is combined: the utmost that can happen is the rupture of one chamber, and this with a force equal to only one-fifteenth or one-twentieth of the whole; and this rupture would release all: an explosion of the whole is impossible, because the bolts and braces

crank axle of the *fore wheel*, as shown in the engraving. The direct application of the power to the crank by this method gave encouraging hopes of success; and the arrangement had this further recommendation, that it admitted great facility in steering. After a variety of trials and alterations, however, it was found attended with so many practical drawbacks, that it was finally abandoned. The writer devoted much time to the construction of a propelling apparatus for this carriage, under the idea that the friction of the wheels would not be sufficient; but experience proved the utter uselessness of any such adjunct, and this first carriage was propelled by the fore wheel alone, which was found to have quite sufficient bite upon the road.

Defective as this carriage was, however, it ran many hundred miles in experimental trips from the writer's manufactory at Stratford, sometimes to Epping Forest, at others to Paddington, and frequently to Whitechapel. On one occasion it ran to Hounslow, and on another to Croydon. In every instance it accomplished the task assigned to it, and returned to Stratford on the same day on which it set out.

Subsequently, this carriage went from Stratford, through Pentonville, to Turnham Green, over Hammersmith Bridge, and thence to Fulham. In that neighbourhood it remained several days, and made a number of excursions in different directions, for the gratification of some of the writer's friends, and others who had expressed a desire to witness its performance. In the course of these

Fig. 1.

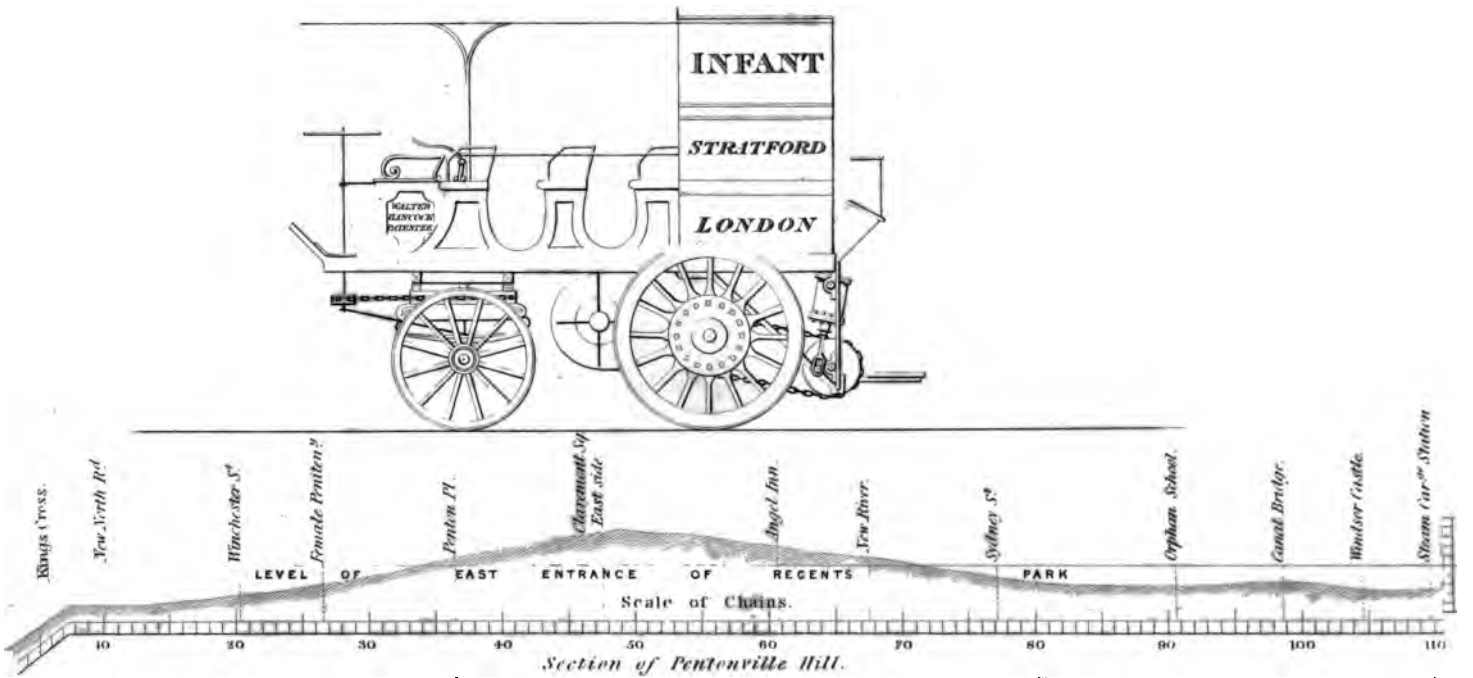


arly experimental trips, the writer experienced the usual fate of all who run counter to long standing usages and prejudices; namely, to be ridiculed by the many, encouraged by but a very few, and fiercely opposed by all whose personal interests were threatened with injury by his proceedings. The popular mind had not yet become sufficiently familiarised to the notion of dispensing with horses in common road travelling. The newspapers had made mention about this time of some *private* trials made by Mr. Goldsworthy Gurney, in a steam drag of his construction; but hitherto there had been no *public* exhibition of any thing of the sort. All had heard something of a scheme for riding by steam, but most persons with much the same degree of incredulity that we now listen to tales of journeying in the air. The writer was the first, or with the first, to offer, to all who chose to come and see, ocular demonstration of the practicability of the thing—to exhibit in the face of day, and on the public highways, a carriage propelled by steam. But though this was evidence not to be gainsayed, it was not a little mortifying to see how the force of it was evaded. Some would admit frankly that the carriage worked well; but expressed as frankly their decided conviction, that it would never answer for a continuance. Others would depreciate its performances, exaggerate its defects, and exult, as it were, in every instance of accidental stoppage. If requiring temporary accommodation, through the failure of some part of the machinery,—a circumstance naturally enough

of frequent occurrence in this early period of his locomotive career, he usually experienced the reverse of kind or considerate treatment. Exorbitant charges were made for the most trifling services, and important facilities withheld, which it would have cost nothing to afford. If, again, he happened to be temporarily detained on the road from want of water, or from any other cause, he was assailed with hootings, yellings, hissings, and sometimes even with the grossest abuse. It is true, this latter description of treatment proceeded chiefly from the rabble; but he regrets being obliged to add, not exclusively so. Great obstruction was also continually experienced on those occasions from waggons, carts, coaches, vans, trucks, horsemen, and pedestrians, pressing so close on the carriage, as sometimes to preclude the possibility of moving. Altogether the writer's situation was in general any thing but agreeable; often most irksome and irritating, sometimes very hazardous.

No ways disheartened by any of these untoward circumstances, the writer persevered in his experiments; and as the novelty of such exhibitions wore off, so also did the excitement and the opposition which they at first produced. Clearer-sighted views and kindlier feelings began gradually to prevail; more serious convictions of the practicability and advantages of substituting inanimate for animate power in common road travelling; and greater readiness to promote, by word and deed, the success of the project.

Fig. 8.



Section of Pentonville Hill.

Having clearly ascertained the disadvantage of applying the power directly to the crank, as before described, the writer next placed the engines quite behind, and at the same time altered the form of the carriage, so as to make it more nearly resemble an ordinary horse carriage. These new arrangements are represented in Plate VI. Much thought and labour were spent upon them, and many alterations suggested and tried from time to time. But the difficulty of keeping the machinery clean, owing to its proximity to the fire-place, as well as to the road, was found in practice to be so strong an objection, that this form of carriage had also to be abandoned.

With this carriage, however, defective as it was, one point of the greatest importance in common road steam travelling was most satisfactorily determined. The possibility of a steam carriage ascending steep hills had been doubted and questioned by many; and to remove, if possible, all scepticism on the subject, the writer fixed a day for taking his carriage up Pentonville-hill, which has a rise of 1 in 18 to 20, and invited a numerous party to witness the experiment. A severe frost succeeding a shower of sleet, had completely glazed the road, so that horses could scarcely keep their footing. The trial was made, therefore, under the most unfavourable circumstances possible; so much so, that, confident as the writer felt in the powers of his engine, his heart inclined to fail him. The carriage, however, did its duty nobly.

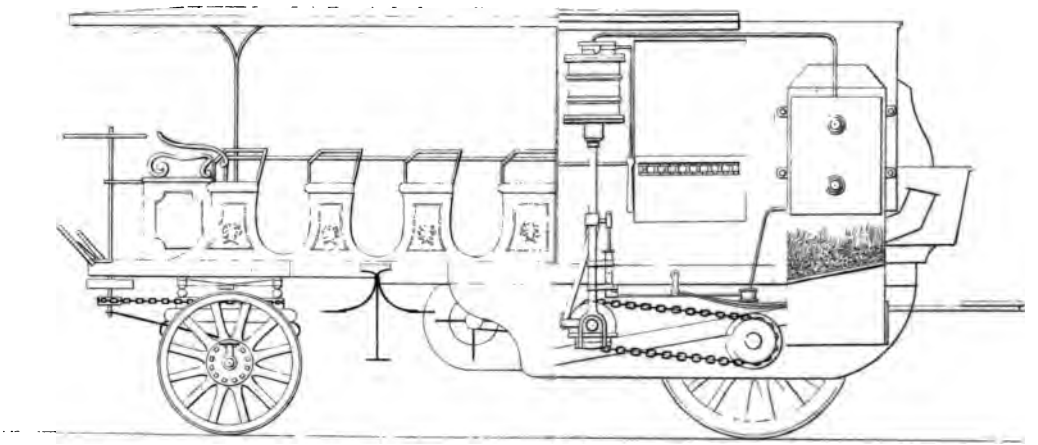
Without the aid of propellers, or any other such appendage, (then generally thought necessary even on a level road,) the hill was ascended at considerable speed, and its summit successfully attained, while his competitors with their horses were yet but a little way from the bottom of the hill.

The feelings of the writer at that moment fully compensated him for all his previous annoyances. He had dissipated the doubts of friends, and disappointed the anticipations of enemies; he had conquered difficulties before deemed insurmountable, and placed the power of steam, in comparison with that of horses, in the most advantageous position. He enjoyed, therefore, the gratifying sensation of having effected a proud triumph, and returned the hearty congratulations of hundreds of spectators in the good old English fashion of proclaiming victory.

The writer was stimulated by these experiments to fresh ardour. Assured that he was approaching towards complete success, he remodelled the entire arrangement of the machinery. The trunnion engines were laid aside, and fixed ones substituted; and such other alterations and improvements adopted, as had suggested themselves during actual work upon the road. The carriage, as thus reconstructed, was called, in reference to the infancy of the undertaking, the "INFANT," and is represented at Plate VII.

The bulk of the machinery, it will be observed, is fixed

Fig. 9.



he rear of the carriage, or body part appropriated to passengers. There is, first, the boiler, with the fire-place er it. Second, a space, between the boiler and passen-s, for the engines and the engineer who accompanies the riage, whence he has the whole of the machinery within reach, and open to his view; and is thus enabled, ing the progress of the carriage, to lubricate the parts uiring oil—attend to the gauge cocks, and regulate supply of water to the boiler, as well as the degree of st from the blower—to increase or diminish the gene-on of steam, according to the various states of the d, and the wants of the engines,—and generally to e his immediate attention to any portion of the chinery requiring adjustment. And, third, a pair inverted fixed engines working vertically on a crank ft.

he steering apparatus is at the extreme front of the riage.

he whole is on one framing, supported by four com-a coach springs, on the axle of each wheel.

n the crank shaft and on the axle of the hind wheels fixed indented pulleys, around which an endless chain ses, which communicates the power and rotary motion he crank shaft to the hind axle, and propelling wheels, thereby effects the progressive motion of the whole iage. When it is desired to back the carriage, the on of the engines is merely reversed, which can be ted almost instantly. The advantages realised by

the improved arrangement shown in the "Infant" are numerous. The engines are completely protected from the dirt and dust of the roads; are at all times in sight of the engineer, and every part of them is within his reach. The passengers, engines, boiler, fire-place, &c., are all equally relieved from concussion, by complete suspension on springs, similar to a stage coach; the chains allowing full play to the springs, and a vibrating stay from the crank to the axle preventing the pull of the chains, and securing a uniform distance between the axle and crank shaft. By the employment, too, of a distinct crank shaft, the axletree, which has to carry all the weight, is not only preserved straight, and consequently of the best form to sustain that weight, but it is also relieved from the strain which it has to bear, where it forms both crank and axle, and has to propel the carriage, and carry the weight as well. The "Infant" thus fitted up, was tried in every possible way, during several months, and proved so perfectly efficient, that in all the carriages which the writer has since constructed, he has adhered to the same general plan of arrangement, with the exception of some modifications in the details, which more extended experience has suggested.

Actual practice on the road, has been from the first the grand test to which the writer has subjected all his ideas of improvement—the entire novelty of the pursuit in which he was engaged, precluded him from obtaining correct data in any other way. Nor were the various experiments which

he instituted, or the necessary perseverance with which he prosecuted them, without many beneficial effects; for as he constantly accompanied his carriage himself, he rarely took a trip that some improvement in minor points did not, in the course of it, suggest itself, or become obvious on inspection of the working parts of the machinery, after the completion of the journey.

But though the general arrangement of the "Infant" was such as to leave but little occasion for alteration, there were yet several important points that remained to be cleared up, such as the best proportions and size for the chambers of the boiler—the best form for each separate portion of the machinery—the proper position, size, and strength of the various parts, and also the most suitable kind of materials, so as to avoid, as much as possible, superfluous weight.

Experiments to ascertain these various points occupied the writer till the beginning of the year 1831, so that full six years had elapsed from the commencement of his locomotive pursuits, before the "Infant" was produced in a state somewhat to the satisfaction of his own mind.

The trials made with the "Infant" during this probationary period, comprise a total of many hundred miles, all made upon the high roads, near London—principally in the vicinity of the writer's manufactory at Stratford. He has been censured (strange as it may seem) for not pursuing his experiments in more retired situations—but he had no motive for shrinking from public observation. Vehicles

of every description being in constant motion on the road from Bow to Whitechapel, afforded him an excellent opportunity of obtaining practical experience, under every circumstance of difficulty, in which a steam-carriage might be expected to be placed; and this consideration alone was sufficient to determine him to give the most frequented road the preference.

In February, 1831, he commenced running the "Infant" regularly for hire on the road between Stratford and London, not, certainly, with an anticipation of profit, although the writer's outlay at this time, as the reader may imagine, had been considerable, but as a means of dissipating any remaining prejudices, and establishing a favourable judgment in the public mind as to the practicability of steam travelling on common roads. It is an undeniable fact, and a source of proud satisfaction to the writer, that a steam-carriage of his construction was the first that ever plied for hire on a common road, and that he achieved this triumph single-handed.

Of its performances at this time, Mr. John Farey, the eminent engineer, made afterwards to a Committee of the House of Commons the following highly-favourable report:—

"Were you ever in Mr. Hancock's carriage when travelling?" "Yes, I have ridden on it. I have examined all his present machinery in detail, and think it very judiciously planned."

"Did you find that it annoyed passengers?" "I found

riding in Mr. Hancock's carriage to be exceedingly like travelling in a stage-coach."

"Did you observe any horses or carriage passing his carriage?" "Yes; there is so much curiosity excited by the novelty of a steam coach in motion, that all the horses on the road are drawn up to get a sight of it, and many are turned to follow it. I have observed that some horses take very little notice of the steam coach, others are a little startled; but I never saw any difficulty which the reins could not control with the greatest ease."

Again:—

"Had you occasion to turn any sharp corners when in Mr. Hancock's carriage?" "Yes, many; the yard of his premises is exceedingly narrow and inconvenient to turn into and out from; but it is done with ease by the steam coach: the same place would not do at all for a coach and four horses to put up at."

"Going at what speed, can you turn round a sharp corner without any danger?" "I do not remember turning with any considerable speed, nor should it be attempted with any carriage if it can be avoided; and there can be no pretence or necessity for going quick when turning a steam coach, as its power is quite controllable, in which respect it has a great advantage over a common carriage. In a steam-carriage, the conductor has such a perfect control of the power, that he can never fail in checking the speed at the moment of turning. I observed

that Mr. Hancock's carriage is steered with the greatest ease, and will turn round in a very short space. I have seen him turn round without backing the carriage at all, although he was in the middle of the road when he began to turn."

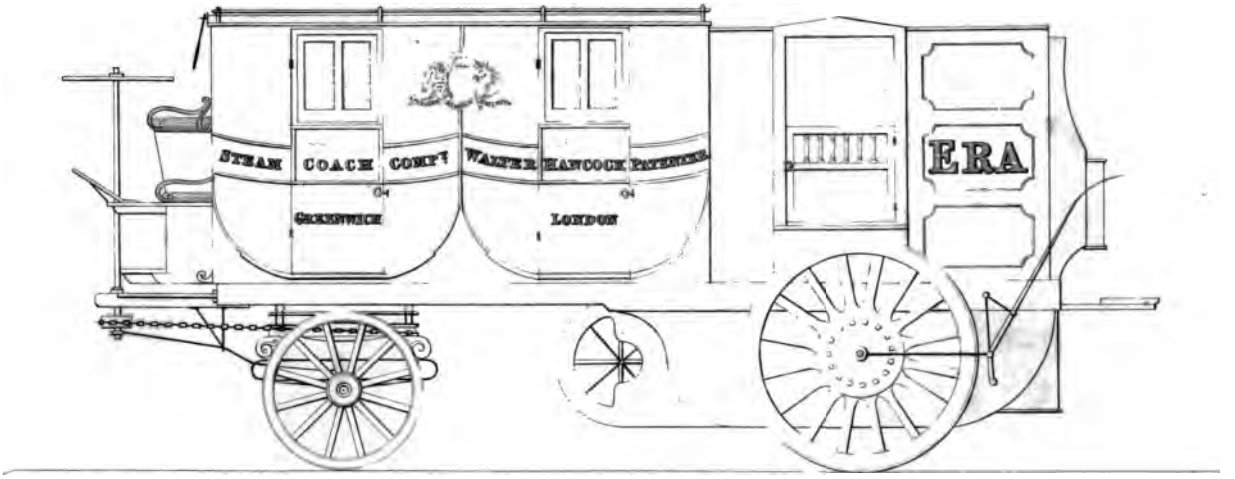
"Have you seen Mr. Hancock's last improvement?" "Yes; I consider Mr. Hancock's boiler to be much better for steam coaches than any other which has been proposed or tried."

"If that boiler were to explode, it is understood that there would be no danger at all?" "It is very difficult to foresee that; at the same time, the risk of explosion in Mr. Hancock's boiler is certainly very much less than in the locomotive boilers which are in constant use, on a large scale, on railways, and where we have proof that the extent of the danger is very small."

The following extract from the evidence given by the writer himself on the same occasion, will show that the danger alluded to at the close of the preceding extract from Mr. Farey's evidence is quite imaginary.

"Suppose one of your boilers were to burst, what would happen?" "I will give the Committee an instance. I was travelling about nine miles an hour at the time; the boiler was the twenty-fourth part of an inch thick. I was working then at 100lbs. on the square inch, with thirteen persons on the vehicle, and all of a sudden the carriage stopped—for what purpose I was at a loss to know. I got

Fig. 10.


STEAM COACH COMP.Y
WALTER HANCOCK PATENTEE
GREENWICH
LONDON
ERA

from my steerage seat, and went to the engineer to ask him what was the reason he had stopped the steam? He told me he had not stopped the carriage; and he immediately applied his hand to the gauge cocks, and found there was neither steam nor water in the boiler. I immediately knew that the boiler had burst. They (the passengers) said they did not know it, as they heard no noise; I told them I did not mean they should know it. I said that I would show them it was so; and I took the boiler from the carriage and unscrewed it, and there were four large holes that I could put my hand into. This occurred from the chambers being too thin; all the water was driven out of the boiler, and yet there was no injury to any person; there was not one person that heard any report; there was no steam, and there were no symptoms in any way that the machine itself had burst."

The next carriage which the writer built was the "ERA," represented in Plate VIII. It was completed in the year 1832. It was ordered by an association of persons styled "The London and Brighton Steam-Carriage Company," and was intended to ply between London and Greenwich. This carriage performed one journey to Windsor shortly after its completion, since which it has only made some trial trips, the Company being as yet undecided as to their future movements.

The writer has now arrived at a period in the history of his locomotive career, when it became rather disagreeably chequered by an association with other individuals. In

the latter end of 1831, a scheme was set on foot for forming a company to run steam-carriages from Paddington to the City; and the writer was applied to for data upon which the estimates of such an undertaking might be formed. A meeting of the promoters of this scheme took place on the 2nd of February, 1832, to inquire into the best means of carrying it into effect. With these proceedings the writer had no connexion further than having acceded to a request to run the "Infant" over the proposed line, for the satisfaction of those who might be disposed to embark in the undertaking.

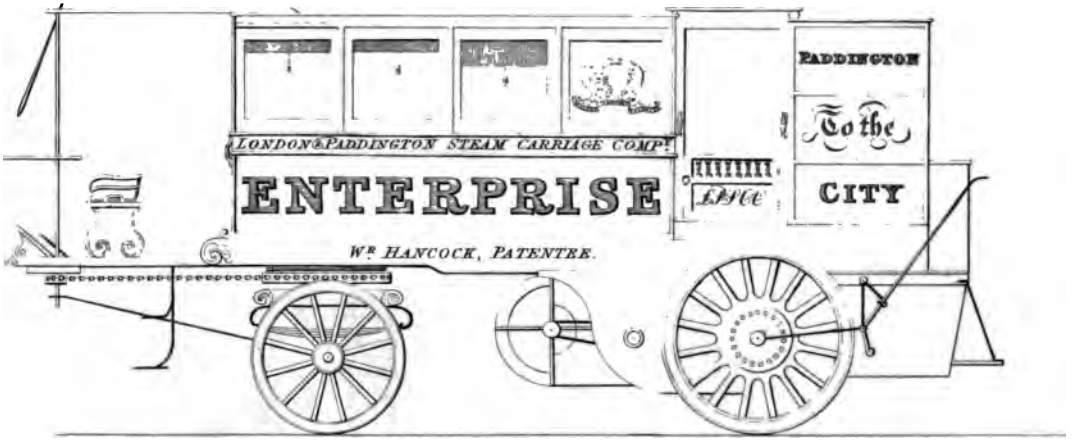
This journey was performed on the 7th of the same month, and, in consequence of the favourable opinion excited by it, another meeting was held on the 9th, which was followed by several others, and at length the company was formed, under the denomination of the "London and Paddington Steam-Carriage Company."

An arrangement was subsequently entered into between the writer and the Company for the building of one carriage, and, in the event of its performing a specified duty, the order was to be extended to two other carriages on a similar construction.

The carriage built in conformity with this order was named the "ENTERPRISE:" a representation of it is given at Plate IX.

It was on the occasion of working the engines of this carriage during its construction, that the only serious accident occurred throughout the whole series of the writer's

Fig. 11.


LONDON & PADDINGTON STEAM CARRIAGE COMP.
ENTERPRISE
Wm HANCOCK, PATENTEE.
PADDINGTON
To the
CITY

experiments; and this, it will be seen from the verdict of the jury and the remarks of the coroner upon the inquest, did not happen from any defect in the principle upon which the boiler was constructed, nor in any part of the machine itself—it was altogether the sufferer's own fault, his, it may be said, criminal carelessness. The following report of the inquest is from the *Kent and Essex Mercury*, of January 1st, 1833:—

"On Saturday, the 22nd December, an inquest was held by the Coroner of Essex, at the Harrow Inn, Stratford, on the body of Richard Outridge, an engineer, in the employment of Mr. W. Hancock, of Stratford, who met his death on Thursday, under the following circumstances:—George Bish, foreman to Mr. Hancock, deposed, that the deceased, who had been some months in the employ of Mr. Hancock, was, with other workmen, putting the machinery of a new steam-coach in action on the premises, in order to try its performances. The witness described the peculiar construction of Mr. Hancock's chamber boilers, and deposed that there were two safety-valves on the boilers in question, one of which he had himself weighted to the pressure of one hundred pounds upon the square inch, the deceased undertaking to adjust the one on the other side of the boiler to the same pressure. The witness then left the carriage for a short time, and on his return discovered that the steam was blowing off very powerfully from the valve which he (the witness) had adjusted, and that the sides of the boiler were rapidly distending. Witness

called to the deceased (who was standing in the engine room of the coach, with his back to the boiler, examining the working of the engines,) to throw off the blower, by which means the fire would have nearly ceased its action, but that the deceased replied he had forgotten to fix the lever on; the deceased then stopped the engines; the witness cast his eyes to the valve which had been left to the care of the deceased, when he saw it fastened down by a strong copper wire; he called to the deceased to relieve it, but before he could effect this (through the wire being twisted several times round an iron punch which the deceased had strongly driven into the wood-framing of the engine-room in the absence of witness) one of the eleven chambers composing the boiler was rent, and the great force of the accumulated steam threw the deceased back against the engines. The deceased was removed into the house, and medical assistance immediately obtained, but he expired in about an hour. The witness, in answer to questions from the Jury, said, that had it been a boiler as constructed by others years ago, much injury must have ensued from the fragments of metal which would have been driven in every direction with great violence amongst the men who were at the time around the coach.

"Other witnesses were examined, and on its being ascertained to the satisfaction of the Coroner and Jury that the fastening down of the valve was the act of the deceased, the Coroner observed, that had the deceased survived, and

any other person met his death, in that case the deceased would have taken his trial for manslaughter, from his culpable negligence in the management of a thing which he, by his occupation, so well understood, it being proved that he had been for a length of time engaged in similar work, and was well aware of the nature and operations of steam.

"The Jury having minutely examined the boiler and engines of the coach in question, as also another coach upon the same construction, and which was put at work for the purpose, and all its parts being explained to them, brought in the following verdict—'Accidental Death, *caused by the deceased's own negligence.*' The Jury added, that they were quite of opinion that Mr. Hancock's boiler, from its peculiar construction, was as free from danger as any boiler could be: in which opinion they are borne out on their examination of the body of the deceased, which was not at all mutilated; neither was the machinery nor the body of the coach injured. The deceased, who bore the character of a steady workman, was twenty-eight years of age, and has left a widow and three children to deplore his loss."

That this accident was occasioned by the rupture of one of the chambers of the boiler, is certain—but it was not in consequence of any bodily injury inflicted thereby, either external or internal—there was neither contusion, wound, or even scratch, upon his person. Some imagined that he was choaked by the rushing of the escaping steam into his lungs, supposing him to be in the act of inspiration

at the time; but this the surgeon, examined on the inquest, denied. His death was occasioned solely by *fright*. It may also be remarked, that he was in a very weak state of health at the time of the accident, having only returned to work on that morning, after an illness of considerable duration.

The "Enterprise" was so far completed by the 26th of January, 1833, as on that day to be taken from the manufactory to the Company's premises, in order that it might be appropriately painted and decorated. In the month of April it commenced running for hire on the road between the City and Paddington, under the writer's personal superintendence, and, on account of the Company: the "Enterprise" continued to run for sixteen successive days. The particulars of the journeys were reported in the current numbers of the *Mechanics' Magazine*, and in the daily papers of the time, from which are selected the following extracts: the first is from the *Mechanics' Magazine*:—

"THE PADDINGTON STEAM-CARRIAGE COMPANY.

"A steam omnibus, constructed for this Company, on the plan of Mr. Hancock, has at length made its appearance on the road between the City and Paddington. We saw it at work on Monday, Tuesday, and Wednesday last, and were very well pleased with the manner of its operation. It seemed to be as perfectly under the regulation of the steersman as any of the rival vehicles drawn by horses, went a good deal faster—as much so, perhaps, as the crowded state of the road would allow, and caused

no annoyance by noise or smoke to either bipeds or quadrupeds. In external appearance it differs little from an ordinary omnibus, and contains accommodations for exactly the same number of passengers. The part for the passengers is in front, the furnace in the rear, and the engine work (which occupies but a small space) between the two. The motive power is communicated by chains. The internal arrangements are, we believe, similar to those of the carriage made by Mr. Hancock, which plied for some time on the Stratford-road, and is fully described in the *Mechanics' Magazine* for the 28th April, 1832. All that (apparently) now remains to be done, is to ascertain the average cost of this mode of conveyance, as compared with horse power; and this, of course, must be an affair of time. We trust the Paddington Company will act more openly by the public in this respect than previous speculators have done; and that they will make known the result of their experience, whatever it may be, without any mystification or evasion."

"Since writing the preceding notice," says the editor of the *Mechanics Magazine*, "we have received the following very frank and satisfactory letter on the subject from a shareholder of the Company:—

"Sir,—The London and Paddington Steam Carriage Company have tried and proved the effectiveness of their carriage, by taking it from Paddington to London-wall, and thence up Houndsditch, through Whitechapel (on market-day), and on to Stratford and West Ham, and

uncertainty existed relative to the precise number of journeys, and some other points, the writer, during the current week, addressed the following communication to the editor of the *Mechanics' Magazine* :—

" MR. HANCOCK'S STEAM OMNIBUS.

" Sir,—More than six years have elapsed since I began my experiments on steam locomotion; and I have followed it with an ardour that did not admit of any diversion from the grand object which I kept steadily in view. During the past week I have exhibited daily on the Paddington-road a steam omnibus, the result of my experience: and having hitherto carefully steered clear both of extravagant anticipations and exaggerated statements, I should be sorry now if any such should find their way into the public prints. In order to prevent this, as far as I am able, I beg to hand you for insertion in your wide-spreading miscellany the following results of the first six days :—

" April 22.—Started from Cottage-lane, City-road, to Paddington, and from Paddington to London Wall and back to Cottage-lane—9 to 10 miles; hour, 8 minutes. Delays, 18 minutes; travelling, 50 minutes.

" —— 23.—From Cottage-lane to Paddington, and back Cottage-lane—8 miles; 1 hour 11 minutes. Delays, 9 minutes; travelling, 62 minutes.

" —— 24.—Same ground—1 hour, 4 ~~miles~~ minutes. Delays, minutes; travelling, 53 minutes.

" April 25.—Same ground, and back as far as St. James's Chapel; piston broke.

" —— 26.—Same ground and back to Cottage-lane—49 minutes. Delays, 5 minutes; travelling, 44 minutes.

" ——27.—Same ground—50 minutes. Delays, 5 minutes; travelling, 44 minutes.

" Average quantity of coke, 1 sack to each trip.

" It is not intended to run this carriage more than about a week longer; partly because it was only intended as a demonstration of its efficiency, and partly because my own occupations will not admit of my personal attention to the steering, which I have hitherto performed myself, having no other person at present to whose guidance I could with propriety intrust it. During the time that it will require to build two or more carriages for the Paddington Company, I shall have one or two others of my own running, which will afford me an opportunity for training steersmen, &c., for this road, which, of all others I am acquainted with, requires the greatest steadiness and attention.

" I am, sir, your obedient servant,

" W. HANCOCK."

" *Stratford, May* 1, 1833.

" N.B.—I would just observe, that your correspondent ' Candidus' has, I think, stated the number of journeys rather too high. From the manner also of wording his letter, it would almost seem to imply that the 'Enterprise' was built in the City-road, and that other carriages

were in progress of building there; but I have no establishment in London, and the 'Enterprise' was built at my own place at Stratford, and had its first trials on that road. I took it to town merely to avail myself of the assistance of London artists in its decoration, &c.; after which, and before its delivery, I ran it over its intended road, &c. as stated by 'Candidus.' Thus much for steering clear of all mistakes."

The following very flattering letter appeared in the *Morning Advertiser* of April 26th :—

"PADDINGTON STEAM-CARRIAGES.

"*To the Editor of the 'Morning Advertiser.'*

"SIR,—It is gratifying to every enlightened and rightly constituted mind to witness any step in advance in the attempts to appropriate more extensively to the service of mankind the great forces with which nature works, and which she employs hourly around us, as if to court our imitation; but it is doubly gratifying to witness the success of those attempts which go to the substitution of inanimate force in our needful occupations, for a force heretofore obtained at the cost of great animal suffering, and of vast expenditure of life, aggravated, too, by a seemingly inevitable deadening of the best feelings of our nature—sympathy with the pain of sentient beings—in that portion of mankind, whose interests have been made to grow, as it were, out of the extortion of the maximum of power from the wretched animals which they use as instruments of gain. Those who go no

further in their contemplation than the abatement of a vast amount of pain and hardship, now accruing to the ill-used animals which slave in our public vehicles, likely to be produced by the substitution of mechanical force for horse power in effecting conveyance on common roads, hail with great satisfaction the appearances which indicate a near approximation to the much-desired, and, in all respects, most desirable, change.

"I have watched with intense interest, for some days past, the first trials of a new steam-coach on the Paddington line of road, the first coach brought out by the London and Paddington Steam-Carriage Company, with the design of carrying passengers for hire. This carriage has so far performed its experimental trips, which it has made once daily during the week, in an exceedingly satisfactory manner. There appears to be an adequate power for the quick propulsion of the vehicle with its load on an ordinary road, certainly not more favourably circumstanced than the generality of public roads through the kingdom; and the machine is more decidedly under the control of the conductor, than is the best appointed and best driven horse coach. Yesterday, in passing through the assembled crowd at King's-cross, a boy, in running across the road, was knocked down and ridden over by a horseman immediately before the coach. Mr. Hancock, who guided the steam-carriage, perceived the accident, and so instantaneously stopped the vehicle as to prevent further mischief; a pair of horses, under the same circumstances, could scarcely have failed to aggra-

vate it. The steam-coach ascends the Pentonville-hill with apparent ease, at a rate varying from six to eight miles an hour. On the level road it makes from ten to twelve. In a complicated piece of mechanism devised for the attainment of a new purpose, it necessarily happens that some of the parts will be found on trial of insufficient strength. It is only experience which can bring all the working parts into due proportion. So it is in the present instance, and will for long be with the infant efforts of steam-coaches; the failure of some of the minor parts causes occasional impediments, and points out where more strength is called for; but these are very tolerable, because remediable evils. When we are once satisfied that we have acquired the needful power, and that it is appropriate to the purpose, safe, controllable and economical, all the subsidiary details of mechanism can readily be worked out by practical judgment and the artificer's skill.

" In watching, as I have done, the early operations of this new steam-coach, the 'Enterprise,' on the Paddington-road, I have been pained, though not surprised, to see the malignant efforts of some of the drivers of the horse vehicles to impede and baffle the course of the new competitor. It is not to be expected that men of their stamp can estimate very correctly the value, the extent, or the results of the great power which is coming into the field against the old system, of which they are certainly very unamiable appendages; but they must be taught by wiser *heads* than their own, and the knowledge must be en-

forced upon them by an authority stronger than that of their own lawless passions, that they must not endanger the lives of the passengers who have intrusted themselves to their guidance, by a wanton courting of collision with a body so vastly more weighty, more strong, and more powerful than their own frail vehicles, and feeble, staggering beasts of draught. One of these infatuated men to-day crossed short upon the path of the steam-coach palpably with a mischievous design, which was only rendered abortive by the vigilance and prompt action of Mr. Hancock. Had these been wanting, loss of life would probably have resulted, and the occupants of the weaker carriage have most cause of self-gratulation on the event. Should any of these ill-judging men provoke a collision, where less vigilance, less self-command, or less forbearance preside over the movements of the more powerful body, they may have reason to rue their desperate folly. Can these men be so stupid as not to see that if they court forcible contention with an antagonist greatly more powerful than themselves they are volunteering their own ruin? But it is not simply the risk of their own violent destruction, and that of their vehicles and horses, which their senseless proceedings incur; they are accelerating and pulling upon themselves prematurely the very evil which they fancy is impending over them—the loss of employ for themselves and their vehicles. The sooner they convince the travelling public that they, the drivers of horse-coaches, are recklessly bent on courting danger

for themselves and for their passengers, the sooner that self-loving public will leave these mad and wicked coachmen to drive their empty vehicles into whatever difficulties or dangers they may severally prefer.

" The change we are about to witness in the system of public conveyance is great and extensive, and ramifies into a boundless field of collateral influences. But it is fraught with positive benefit to man; gives ampler scope to those feelings which indicate his advancement in civilisation and humanity, and the means of effecting it are within our grasp, therefore the change must and will come; but like all other extensive changes in human pursuits, it will be slow and progressive. It will not be like the tempest, but like the course of the seasons. It will allow every one of the present race of horse tormentors to run out his brief career in the exercise of the lowest passions which debase our nature. The common casualties of their intemperate lives and hazardous avocations will furnish ample vacancies for the necessarily gradual introduction of the new power. The dealers, workers, whips, curry-combs, and cads of the present hour, will find the means of enjoyment in their own peculiar ways to the end of their days. The only mournful anticipations which they can reasonably draw from the impending change is, that they will not be enabled to bequeath brutality and blackguardism as heir-looms to their posterity. But this evil in the background ought not to embitter their present hour. Let them drink,

curse, and wrangle as usual, and, like sensible men, leave unborn posterity to its own shifts, and to become wiser and better than themselves, if possible.

" I am, Sir, your obedient Servant,

" OBSERVATOR."

" April 26, 1833."

Every imaginable variety of annoyance, as is mentioned, and very justly commented upon in the above letter of " Observator," was practised by the drivers of the Paddington omnibuses; but as this had been anticipated, the writer had previously determined to use the greatest circumspection, so that, if any accidents should occur, the blame might rest on those whose conduct should occasion them. He has, however, the satisfaction to state, that, notwithstanding the repeated attempts to place him and the passengers in situations of great danger and difficulty, even so far as to cause a collision of vehicles, no accident occurred in the course of any of these journeys. A single instance will suffice to show the extent and nature of the opposition which was carried on, and is selected by the writer in preference to others, in consequence of its having formed the subject of a complaint published on the following day in the police reports of the London papers, of which the subjoined is a copy from the *Morning Advertiser*, May 4th, 1833.

"WORSHIP-STREET.—THE STEAM OMNIBUS.—Yesterday, John Hall, driver of the Paddington omnibus, No. 3926, appeared before Mr. Broughton, upon sum-

mons, charged with driving against, and wantonly damaging the steam omnibus recently started upon the Paddington-road. The fine of 5*l.* was, in consequence of the defendant's good character, mitigated to 40*s.* and costs, which he immediately paid. The moiety of the penalty due to the complainants was left by them for the use of the poor."

After this check the annoyance in a great degree subsided.

The writer has the gratification to record here a circumstance highly to the credit and liberality of the Government—the exemption of steam-carriages, during the infancy of the invention, from the imposition of any duty, by a particular clause in the Hackney-carriage Act. A gentleman, connected with the public vehicles, thinking that, by running only from Paddington to the Bank, they came within the limits of the Hackney-coach Act, and were, in fact, steam hackney-coaches, requiring a license—a *pro forma* information, for the purpose of deciding the point, was consequently laid against the writer at Bow-street. The magistrates, after a week's consideration, decided that the wording of the Act did not appear to them to exonerate steam-carriages from the liability. On presentation, however, of a memorial to the Government, founded on this decision, a clause was introduced into a bill then passing through Parliament, with reference to hackney coaches, declaring the act not to be deemed to extend to steam-carriages.

The "Enterprise" having exceeded the stipulated per-

formances, the writer naturally expected directions for the fulfilment of the contract entered into between him and the Company, namely, to build two steam-carriages on a similar plan. Various pretexts were, however, resorted to for delay, which subsequent proceedings proved were merely employed by a party as feints to conceal a design which, for effrontery and dishonesty, has seldom been exceeded. The writer will not interrupt the thread of his narrative by entering here into a detail of these proceedings, but as an evidence that he has not applied to the conduct of the party in question inappropriate terms, copies of two letters, which terminated a long and tedious correspondence on the subject, will be inserted, together with a few observations, in the Appendix. This the writer has considered advisable also on other grounds—that of enabling some of the individuals more immediately implicated, but whom he has reason to believe were never assenting parties to these proceedings, fairly to compare the writer's conduct with that pursued by others in the transactions referred to. At first the writer contemplated the publication of the whole correspondence, and nothing but its length and want of general interest has deterred him, most reluctantly, from this course; he begs, however, to state his readiness at all times to submit it to the inspection of any interested party who may be unacquainted with its true bearings.

Chronological order has been deviated from in some degree, in order to bring all the writer's transactions with the Paddington Company together: this having been done,

he now returns to the period at which the narrative was broken in upon.

On the 31st of October, 1832, the "Infant" took a trip to Brighton, the following account of which is quoted from Mr. Alexander ~~Garden's~~ Gorden's "Journal of Elemental Locomotion:"—

"JOURNEY TO BRIGHTON BY MR. WALTER HANCOCK'S STEAM-CARRIAGE.

"Mr. Hancock having intimated to us that he proposed trying his steam-carriage, modestly yclept 'The Infant,' on the turnpike road to Brighton:—despite of the article in the 'Foreign Quarterly,' the best upon locomotion which has yet appeared in any periodical—despite of the Reviewer's opinion, that Mr. Hancock's carriage 'does not seem adapted for rapid motion,' we ventured to accept the invitation, with the certain conviction, that we should ultimately reach Brighton, and return, unscathed by the scaldings, to give an unbiassed and satisfactory account of our trip. *Ecce signum!*

"The 'Foreign Quarterly,' we find, is *foreign* in this instance. Therein, it is said, 'imperfect suspension has been the ruin of every machine that has yet been constructed.' This 'Infant' has been growing for many months, and improving apace,—a promising child of art. Not only has the 'Infant' not been ruined by 'imperfect suspension,' but it is so admirably and completely hung on 'steel springs,' as the coach advertisements used to announce 'sixty years since,' that the master-hand of Houl-

ditch, in Long Acre, or Windus, in the City, could not have shielded us from concussions more delightfully; and not only were so luxuriously and tenderly treated, but the engine itself was equally saved from the roughness of the passage.

"The crank-shaft, upon which the engines work at right angles, communicates its motion by two chains to the straight hinder axle; thus causing one or both wheels to revolve, and the carriage to be propelled by the adhesion of the periphery to the road. Any shock, which effects the carriage, can only be felt by the steam-engine, through the chain or through the very flexible springs upon which the body of the vehicle, containing engines and passengers, is placed.

"From the extreme ends of the hinder axletree to the corresponding ends of the crank-shaft, strong bars proceed. These bars serve to keep the crank-shaft always equi-distant from the hinder axletree; so that any concussion, which may affect either the wheels or the body, cannot force the crank-shaft nearer or farther from the axletree. These rods are constantly vibrating; but the steam-engine is securely and *perfectly suspended.* We do not say, that the whole affair will not be susceptible of great improvement; nor, we apprehend, does Mr. Hancock. Its name, the 'Infant,' implies beauty and efficiency of structure; but does not pretend to robust and active maturity.

"Well do we recollect Fulton's first steam-boat: numberless were its imperfections, and irregular were its time

and its operations, when first launched on the public gaze. Then was its infancy—now we see it increased in magnitude, speed, and fair proportions; but when it will arrive at the *ultima Thule* of perfection, who will presume to predict? Once, Fulton's boats were at the tender mercies of the rival Albany sailing packets. Eventful time! how hast thou changed its lot, and enabled it in better fortune, to *lead* the sailing craft 'gainst wind and tide.'

"On Wednesday, October 31, this steam-carriage came from Stratford, through the streets of the City, at the different speeds necessary to keep its pace behind or before other carriages, as occasion required, and took up its quarters on Blackfriars-road, to prepare for the following day's trial. Accompanied by a scientific friend, a distinguished officer in the navy, we, determined upon criticism, joined Mr. Hancock's friends on the Thursday morning, making eleven passengers in all.

"We started at a quarter past six o'clock, at the rate of nine miles an hour, until we came to Streatham, where we took in water. Proceeding again at the same speed, we passed Croydon, where we took in coke. In the course of a few miles we found the speed decreasing, without apparent cause. For three or four miles it varied from six to eight miles an hour, until we reached Hooley-lane, where we again took in coke, which had been sent from Croydon. This coke being of a very inferior quality, hard and heavy, was, no doubt, the cause of the falling off in speed. As we approached Red Hill, the coke boxes getting low, the fireman came again to a small

quantity of London coke, when the carriage immediately improved its speed, and carried us up the hill (a hill on which all the coaches in such weather require six horses), in fine style, at the average speed of six and seven miles an hour. Soon after, the bane of our journey, an insufficient supply of fuel, caused us to flag, within sight of our station at Horley. A return post-boy took a message forward, and we were met by a wheelbarrow with a bag of coke, which carried us to the King's Arms. We now took in water and a scanty supply of fuel, and started at a fair speed over Crawley Common to Hand Cross; and taking the small quantity of coke that had been left there, we soon arrived at the King's Arms, Hazledean, where we had the extreme mortification of being obliged to put up for the night, simply for want of coke. We had, however, steamed thirty-eight miles under great disadvantages. A friend proceeded immediately to Brighton, by the horse coach, and forwarded coke, the only thing necessary for proceeding in the morning. This arrived accordingly; the steam was soon got up, and off we set in good style, continuing our course at the varied rate of nine, ten, and eleven miles an hour, till we came within two miles of Brighton, where we fortunately met with a small supply of fuel. Thence we proceeded to Brighton, passed to the Pavilion-gate, round the Grand Parade and Waterloo-place to the town tank, apparently to the great surprise and satisfaction of a large concourse of persons who had by this time assembled. After staying about an hour in Brighton, waiting for our ill-arranged feed of

coke, we started with four additional passengers, two gentlemen and two ladies, on our return, at nine or ten miles an hour, till we came to the end of the dead wall. Here our friends alighted, and we were off again at full eleven miles per hour. The speed of the carriage here increased in an extraordinary manner, although upon a very considerable ascent all the way. One of the miles was done in three minutes and a half, and that which terminates at the branch road to Cuckfield and Piecomb, was done in three minutes fifty-eight seconds (above fifteen miles an hour), reaching Aldbourne (nearly ten miles) within fifty-five minutes, including stoppages for water. The small quantity of fuel we obtained here, only enabled us to reach our former quarters at Hazledean, fifteen miles and a half from Brighton.

"With great unwillingness we were now compelled to leave them, although we had been so much delighted with the trial, that we would gladly have remained, had other engagements permitted.

"A gentleman, whose account we can every way depend upon, has furnished us with the following continuation :—

"'The ill-arranged supplies of coke (perhaps *necessarily* ill-arranged, for few country people on the road knew what coke was,) detained the steamer for the night (of Friday), whilst a messenger was sent forward for a supply of coke. From hence to Handcross was by far the most critical and interesting part of the journey. Almost the whole distance is an ascent, and one part is a hill nearly

a mile long, terminating in a still steeper ascent. No anxiety would have been felt for a carriage built for such a road, but the thing was to be done by the 'Infant.' We were told that we should never get up Slaugham Park Hill; the road being in so bad a state that the stage-coaches, at the best of times, put on two extra horses However, in the morning, the fire-bars were well raked, and the best fire made, of which the stock of fuel would admit. A little coal was added to help out, and the 'Infant' started to the task. A run of two or three miles before coming to the hill, so as to have blown the fire a little, would have been better. As it was, the ascent was commenced cheerfully, the pace gradually decreasing till we came to the steepest part. Here three or four of us got off, and the engine was stopped for a minute or two to raise the steam higher. Again started slowly. The engine laboured, and evidently had no power to spare. In a few minutes, however, all anxiety was at an end, and this imperfect, experimental, and weakly 'Infant' cleared all its difficulties, and arrived at Handcross. Two gentlemen in the neighbourhood, Mr. Kinder and a friend of his, came on purpose to witness this part of our performance, and declared that they had fully made up their minds to witness a failure, conceiving the achievement impossible. The landlady, Mrs. Bachelor, at Handcross, *could not* lend pails, nor would she spare us water, and we might have been in an awkward position had not Mr. Steel, the wheelwright, generously come forward, and offered us his well water and workmen, together with his

own active exertions, to supply our empty tanks. Mr. Steel, and one or two others, took their seats on the steamer, and we were presently off again; speed, two miles in ten minutes. We reached Horley without being able to hear of a relay of coke, which had been promised us at Crawley. It was now perceived that one of the wheels rolled considerably, so as to produce a great deal of friction by the tire and felloe rubbing against the side of the carriage. This gradually got worse till we came to Salford Mill, twenty-two miles from London, where we stopped to examine. The owner, Mr. Newnham, in the most handsome manner, gave the use of his yard. The cast-iron flange at the back of the nave was broken off all round, and it was useless to attempt proceeding until the wheel was repaired. We accordingly left for town, but not before experiencing, at the hands of Mr. and Mrs. Newnham, the hearty welcome and the good cheer of true English hospitality.'

"OBSERVATIONS.—This experimental trip will be viewed by different persons in different ways However, this one thing is certain, the carriage that has performed it was ill calculated for the undertaking. Independent of the smallness of the boiler, intended only for experimental purposes; the carriage itself is a thing of 'shreds and patches,' having undergone endless alterations and trials. The roads, which were become exceedingly heavy from the previous rains, had not been so bad for twelve months before; and it is not improbable that had the experiment been made during the fine weather of the previous week, we should have got back to town on the

day we started. It is better as it is; because the heavy roads have brought this comparatively fragile machine to a test so severe, that the most sceptical can hardly fail of arriving at the obvious conviction, that if the 'Infant' has proved itself almost equal to the task, maturity cannot fail to perform it with ease and regularity.

"It is gratifying to observe, that upon the whole we met, almost universally, with good-will and attention to our wants all down the road: great curiosity and interest were excited, particularly among the ladies; and at Brighton, notwithstanding the unpleasant state of the weather, the concourse of people before we left was very great. Not the slightest accident, however, occurred, either there or on any part of the road.

"Some of the coachmen were exceedingly civil and polite, and voluntarily told us their horses passed the steamer without any trouble. Mr. Wilkins, of the Coronet, is one of them. Others again shook their heads like Washington Irvine's doubter.

"On this trip, the water, not being regularly stationed, as it must be when a steam conveyance is established was sucked by the engine through a huge proboscis, one of Hancock's caoutchouc hose pipes, forty feet long. It answered the purpose admirably; but required much exertion from the workmen, whose zeal and persevering activity were in every case highly praiseworthy.

"We were invited in our editorial capacity, and went for the purpose of criticising, not as the friend of the inventor. We were delighted with the regularity of the

speed and soundness of the work, in very trying circumstances, and highly gratified by the politeness and practical knowledge of Mr. Hancock. The defect of the journey was in the supply of coke, which, in a good state of the roads, need not have been more than half a bushel per mile; on this trip it exceeded the half bushel considerably, perhaps twenty-five per cent. The only discomfort of the journey was a feeling of the want of courtesy, which our conductor showed to other coaches. He most obstinately kept the crown of the road, to our great annoyance; and when he did take the side, it was not to the extent he ought. Steam conductors must conciliate.

"A word to the person by whose order fifty yards of Streatham *Hill* was covered with broken stones, six inches deep all the way across, '*to prevent the return of the steam-carriage.*' We withhold his name; though such an exhibition of ignorance and hostility well entitles it to public exposure. We have taken upon us the duty of advocates for elemental locomotion; and, whilst we shall endeavour to discharge ourselves of the task, with courtesy to all who choose to stand up against it in the fair field of argument, we will not be slack to reprobate the conduct of whosoever resorts to any other means. We are not ashamed of being warm in the cause:—for it is associated both with humanity and patriotism. When next the individual we allude to reads of a ship-load of poor emigrants, let him consider, that twist the case as he may, still the affecting truth must meet his inquiry—that they are torn from home, from country, from kindred, and friends, to

leave a sufficiency for these now unproductive and unnecessary consumers of *the food of the poor*—the horses which he desires to preserve."

The "Infant" again ran to Brighton in the month of September following. Mr. Busby, the well-known architect and engineer of that town, who personally witnessed its performances while there, gives an account of them in the following letter to the *Brighton Herald*:—

"HANCOCK'S STEAM-CARRIAGE.

"*To the Editor of the 'Brighton Herald.'*

"SIR,—I have thought a few particulars of the visit of Mr. Hancock and friends, in his steam-carriage to this place, would not be unacceptable to your numerous readers.

"Mr. Hancock and party started from Stratford, in Essex, three miles and a half east of Whitechapel, a few minutes before six o'clock on Wednesday morning, and arrived at Brighton forty minutes after three, having transacted, when in motion, at the pace of twelve miles per hour; the whole distance from Stratford was about fifty-seven miles, and all the time not occupied in progression was expended in taking in water and coke, and in ~~that~~ those no less necessary operations, of breakfasting and dining on the road; the stoppage on the latter account being two hours and a half, as the party thought themselves entitled to regale at the Pitt's Head.

"Yesterday the steam-carriage made a *detour* through the Grand Parade, Church-street, New-road, East-street,

and along the Cliff to Brunswick-terrace, going round Brunswick-square, and returning along the Cliff, when, unluckily, an inferior part of the mechanism, technically called a *clutch*, gave way, and led to the fracture of a cogged wheel, which gave motion to the centrifugal fire-fanner, and the carriage was brought to a dead stand. This accident would have been speedily remedied, had Mr. Hancock been provided with a spare wheel; but as it was, he was compelled to wait until Messrs. Palmer and Green, who very kindly rendered every assistance in their power, were enabled to cast a new wheel, which was a work of considerable difficulty from the want of a model, the fractured wheel being a most awkward and unmanageable substitute.

"Mr. Towner, of the above firm, accomplished the object in a masterly style, and the carriage was put in motion, and lodged at the Kerrison Arms, Mr. Ireland having in the handsomest manner volunteered the use of his premises on the occasion.

"To-day at one o'clock, every thing being set right, the carriage was started again—it went westward, to the extremity of Adelaide Crescent, and turned round; it then came up the Wick-road to my house, where a few of my friends were taken up, and the party proceeded along the Cliff to the Chain-Pier entrance; then back again to Brunswick-terrace, and returned along the Cliff, through East-street, North-street, the New-road, Church-street, and the Grand Parade, to the Tank at the New Church, where, after taking in a charge of water and coke, the carriage proceeded on its way towards London.

"On the occasion of yesterday's trip, Mr. Hancock was, among other gentlemen, favoured with the company of Captain Heaviside and Mr. Ricardo, who are well known among us for their scientific acquirements; and this day Captain Heaviside and myself had the pleasure of accompanying Mr. Hancock to the Pitt's Head, sixteen miles on his road homeward. That distance was accomplished in one hour and forty minutes, twenty minutes of that time being spent in taking in coke and in procuring water from ponds at various places as they presented themselves on the road. The stoppages under an organized system would not require six minutes.

"I am, Sir, your very obedient servant,

"C. A. Busby."

"Stanhope-place, Brunswick-terrace,

Friday, Sept. 13, 1833."

This account being extracted from the Brighton paper to the *Mechanics' Magazine*, the writer thought some further particulars necessary to be published, and accordingly addressed a letter, of which the following is an extract, to the Editor of that work, which was inserted in the number for November 2nd, 1833:—

"Sir,—Having read in your Magazine of September 21, an account of the trip made to Brighton on the 11th by the 'Infant,' I forward for insertion the following particulars connected with that journey, and with steam-locomotion generally.

"We were retarded in our progress, as on our former journey to the same place, by an irregular supply of

might be liable, even in the most crowded thoroughfares, and fully establishing the writer's own confidence in its fitness for all the purposes to which horse carriages are at present applied.

Since that time the writer has frequently run his carriages during the busiest part of the day, through the most crowded streets of the metropolis, never turning out of his way for the purpose of avoiding them, and this without causing any accident.

In the month of October, 1833, the "Autopsy" ran for hire, between Finsbury-square and Pentonville, and continued to do so daily without accident or intermission for nearly four weeks. The inconvenience, however, resulting from the want of suitable premises and stations for the store of coke, supply of water, standing for the carriages, &c., superadded to the necessity of the writer's daily personal attention at this period at his manufactory, at Stratford, induced him to withdraw it until he should have completed at least one more carriage. His intention in this instance was interrupted by an order, which he received in the spring of 1834, to build a small steam drag or tug for a gentleman of Vienna, which was completed and shipped for its destination in July of the same year.

A represention of this machine is given in Plate XI. It differs from his other carriages only in not being provided with the accommodation necessary for passengers, it being intended to draw after it any vehicles which might be attached to it. Although the "drag" or "tug" system possesses some advantages, such, for instance, as greater

compactness of the machinery, a subdivision of the weight, and some others, yet after mature deliberation the writer gives a decided preference to the plan of carrying the power and passengers on the same carriage.

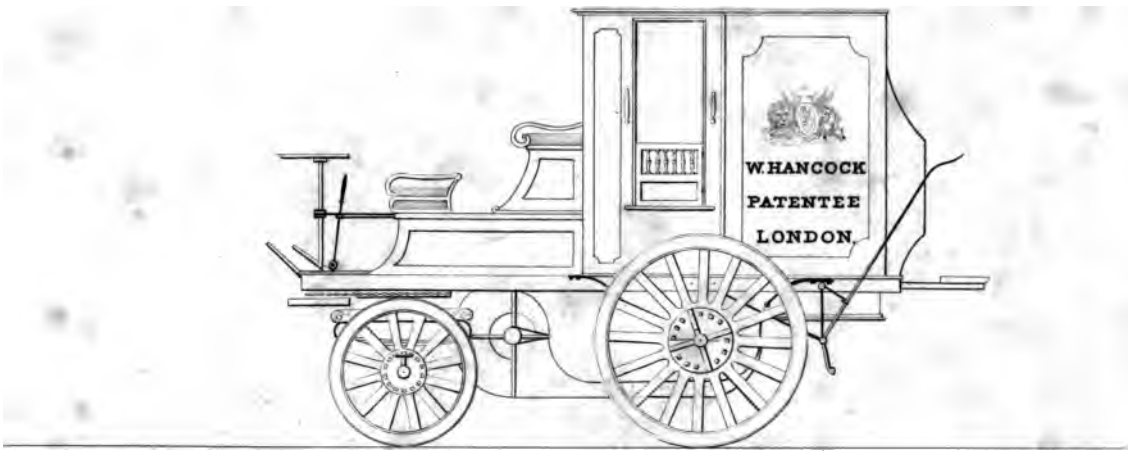
This machine underwent a variety of trials previous to its leaving England; on one occasion it carried seven passengers and three attendants on itself, and a close four-wheeled carriage, occupied by six other passengers, was attached behind, making in all sixteen persons, seven above the number stipulated for. Thus loaded it was steered by Mr. Voigtlander, the proprietor, through Bow to Homerton, Clapton, Crouch-end, and over Stamford-hill, to Tottenham, thence through Ball's-pond and Islington, to the City-road: the distance altogether being about fourteen miles. The speed at which this trial-journey was performed was fourteen miles an hour on the level road, and from eight to nine miles an hour up the hills.

By the month of August of the same year (1834), the writer completed another carriage, called the "ERA," * and having in the interim fitted up premises in Windsor-place, City-road, with all the requisite conveniences for a steam-carriage station, and effected arrangements for the necessary supply of water, also at the Paddington-end, on the 18th of that month he recommenced running for hire daily with his two carriages, the "Autopsy" and "Era,"

* See Frontispiece.

† The distance from Moor-gate to Paddington and back is nine miles, and the time occupied in the completion of this distance, including numerous stoppages to take up and sit down passengers, obtaining supply of water and fuel, averaged one hour and ten minutes.

Fig. 13.



Drag built for M.r Voigtlander of Vienna.

between the City, Moor-gate, and Paddington, and continued to do so without intermission (except on occasions which will be noticed hereafter) till the end of November.

During the running of these carriages the writer was highly gratified with the liberal patronage and encouragement which he received from the public generally of this new mode of conveyance: this, no doubt, partly arose from the steam-carriages starting punctually, and performing the journey in less time than the horse vehicles. The number of passengers carried amounted, during this time, to nearly 4000.

The following account of the travelling on this occasion is extracted from the *Morning Chronicle* of the 19th of August:—

"STEAM-CARRIAGE TO PADDINGTON.

"The steam-carriage which ran between Pentonville and Finsbury-square, during a part of the autumn of last year (and for which Mr. W. Hancock, a gentleman who is indefatigable in his exertions to make the powers of steam available to the purpose of propelling carriages on common roads, has obtained a patent), has resumed its station on the same road, and will now continue regularly to ply between Moorfields and Paddington. The carriage is capable of carrying ten or twelve passengers, besides the persons required in its management. It started from Moorfields yesterday morning on its first trip, at a few minutes after ten o'clock, with a full complement of passengers, and completed the journey to Paddington (five miles), in half an hour, including stoppages; the rate of

travelling, exclusive of stoppages, was exactly twelve miles an hour.

"This rate must not, however, be considered as a criterion of the velocity of which the carriage is capable, as at no period of the journey, excepting in going up Pentonville-hill, was the whole power of the steam applied; and accordingly at intervals, a considerable quantity of extra steam was allowed to escape. The patentee stated that his object was rather to show the public that they might depend on his steam-carriage as a safe and steady means of conveyance, than to acquire an extraordinary, and, as it would be on so crowded a road, a dangerous degree of velocity. The first trip (the only one which we saw) was attended with complete success. The carriage proceeded on its route quietly and steadily. It appeared peculiarly easy of management, and was directed through a crowded thoroughfare with a neatness and precision equal to the best-driven horse-coach in the kingdom. In the course of the journey it was occasionally driven faster, occasionally slower, and sometimes it was stopped altogether, and that with a quickness which was perfectly wonderful, and would be impossible in a horse-coach going at the same rate.

"The motion of the carriage is as easy as that of a common carriage, and is unaccompanied by any disagreeable or startling noise.

"The noise is not greater than that of a common omnibus; indeed so trifling is it, or the peculiarity of the appearance of the machine altogether, that horses meeting

it hardly appeared in the least degree frightened. There is neither smoke nor disagreeable smell of any kind; the motion is not so great as in a coach; and, in short, as a conveyance, it is fully as comfortable as the best-constructed stage-coach.

"In returning to Moorfields, some little time was lost in ascending Pentonville-hill, owing to the fire having been allowed to get low; but, by the application of a few puffs from the blower, the difficulty was got over, and it proceeded up the hill at a diminished, but sufficiently rapid rate. On the whole, the result of the first day's trip has been such as cannot leave a doubt upon the mind as to the ultimate success of steam-carriages upon common roads. No roads in the neighbourhood of the metropolis, and few in the kingdom, are more difficult to travel than that which Mr. Hancock has chosen for the scene of his exertions; and since he has been successful on it, there can be no doubt of his being successful on almost any other roads.

"The great question as to the expense incurred in running steam-coaches is still to be determined. It is stated by all who have any knowledge of the subject to be extremely small, but in their estimates we suspect they lay too little to the account of tear and wear, investment of capital, and incidental expenses. Mr. Hancock is at present, however, keeping an exact account of his expenses, which will give more exact and particular data on the subject than we hitherto have had; and we hope at some future period to be able to publish it. Meantime we can say, that Mr. Hancock has our best wishes for his success. He has spent a great deal of valuable time,

and expended a large amount of capital, in bringing his carriage to perfection; and we should consider it a misfortune to the public, as well as a matter of regret to all the lovers of science, if a gentleman who had displayed so much spirit should be an ultimate loser by his exertions.

" Great crowds were attracted to all parts of the route which the steam-carriage took to witness its performances, and great numbers went away disappointed at not been able to obtain a seat in it. We understand that Mr. Hancock has two other steam-carriages now building, which he intends shall also ply upon the Paddington-road; and we have little doubt of their being all kept in full employment."

About the end of November the writer was induced, at the particular request of some influential parties, to make arrangements for the conveyance of one of his carriages to Dublin, and in consequence discontinued running on the Paddington-road.

The " Era" was the carriage chosen for the trip, and preparatory thereto, its outward embellishments were altered, and its name changed in compliment to the country of its temporary destination, from " Era" to " Erin." It was shipped on board the " Thames" steam-vessel on the 30th of December, 1834, and arrived safely in Dublin on the 6th of January, 1835.

On being landed, the writer commenced running it on the Howth-road, and through all the principal streets, and most frequented thoroughfares of the city of Dublin. As this was the first steam-carriage that ever plied upon any common road in Ireland, its appearance naturally attracted an immense

concourse of spectators; all of whom, as well as those who rode in the carriage, and the public prints of the City, bore ample and gratifying testimony to the efficiency of its performances.*

Stewart's Dispatch of the 19th of January gives the following account of its running:—

"HIBERNIAN STEAM-COACH COMPANY.

"Since the experimental locomotive carriage, the "Erin," has commenced running through town, we have invariably had bad weather, with the exception of yesterday; it does not, however, seem to have had the least effect on the carriage: hail, rain, or snow, has not prevented the 'Erin' steaming through every part of the City daily. The directors, very prudently, never gave any previous notice of their route, or the hour; still the crowds were tremendous. The 'Erin,' on Saturday, left the station-house at Clontarf with a large party of ladies and gentlemen, at one o'clock, going by Ballybough and Annesley bridges, through Abbey-street, Sackville-street, Westmorland-street, Grafton-street, Nassau-street, and Dawson-street, to Stephen's-green, round which it went three times, at the rate of eighteen miles an hour: it then returned to the station-house in Great Brunswick-street, where having taken in a supply of water, it proceeded to Sackville-street, at the time crowded with vehicles of every description; this street it traversed repeatedly, showing the perfect control the steersman has over the carriage; he turned a dozen different times,

* On its first appearance in the streets of Dublin, it was imagined by some that one of the Dublin and Kingstown railroad engines had broken from the rail, and ran into the town.

in a shorter space than any carriage drawn by horses would have ventured on. After going round Mountjoy-square, and the other leading streets on the north side of the City, the carriage returned to the station at Clontarf. The total absence of noise or smoke, and the little notice taken by horses, is most extraordinary."—*Stewart's Dispatch, January 19th*, 1835.

Having remained eight days in Dublin, a period, the writer conceived, fully sufficient to effect the purpose of the visit, the carriage was re-shipped on board the "Shannon," and arrived safely at its old quarters at Stratford.

As experience had proved that in some instances even the "Era" engines were scarcely powerful enough to bring the loaded carriage over new-laid gravel in steep ascents, the writer determined on building a larger carriage, capable of carrying twenty or more passengers, to be propelled by engines of larger capacity. This carriage, when nearly finished, was, at the particular request of a party, converted into a drag, and on some of its first trials drew after it, on a level road, at the rate of ten miles an hour, three omnibuses and one stage coach, carrying in the whole fifty passengers. On the 30th June, 1835, this drag, with an omnibus in tow, took up at the House of Commons, a party of gentlemen, eighteen in number, and proceeded through Whitehall, Charing Cross, Regent-street, Oxford-street, and by Shepherd's Bush, to the neighbourhood of Brentford, and returned by the same route at the rate of fourteen miles an hour, leaving the party at Charing Cross.

On another occasion, with an omnibus in tow, it took a

party to Reading on the 18th July, 1835. The distance, thirty-eight miles, was done in three hours, forty minutes, twenty-five seconds,—thirty-two minutes fifteen seconds of which there was of delays, leaving three hours, eight minutes, ten seconds, actual running, or at the rate of upwards of twelve miles an hour, a speed which the writer believes might easily be maintained on good roads.

In the beginning of August, in the same year, the writer ran the " Erin" to Marlborough, and back again. The following account of the trip, by one of the passengers, is taken from the *Mechanics' Magazine*:—

JOURNEY FROM LONDON TO MARLBOROUGH IN MR. WALTER HANCOCK'S STEAM-CARRIAGE, THE " ERIN."

" SIR,—The ' Erin' steam-carriage, which was built by Mr. W. Hancock, to run on the Paddington-road, and originally called the ' Era,' started from Stratford on Tuesday morning last, at half-past four, for Marlborough, with a party of gentlemen. Mr. Hancock had attached a small tender to the carriage, containing coke and water sufficient to have lasted us to Reading; but the bar of wood, through which the bolts ran that fixed the tender to the carriage, gave way in Cheapside, and we were obliged to leave the tender behind us.

" The carriage reached Hyde-park Corner by six o'clock, where we remained about half an hour to take in some more of our party, and proceeded on to Reading, which we reached at eleven minutes past eleven o'clock. The company stopped

there an hour and a half and dined; after which the journey was resumed.

"The carriage reached Marlborough by half-past six o'clock, with no other accident than the breaking of one of the bands of the blower. The total time on the road was a minute or two short of twelve hours, of which four and a half were occupied in stoppages, leaving seven and a half hours for travelling the seventy-five miles, being at the rate of just ten miles an hour.

"No one who has not travelled by steam-carriages can imagine the inconvenience and delay which results from the want of regular and ample supplies of water; the carriage having to stop from fourteen to eighteen minutes every ten or twelve miles to fill the tanks by hand-buckets from pumps, with sometimes the additional inconvenience of having to take the supply from some neighbouring stream or pond. While the carriage is stationary, the fire slackens in consequence of the blower being stopped, and it requires about two miles running to get it again into full play. By observations which I made on the road while timing the carriage, I found that the rate of the first three miles after taking in water, averaged seven and half minutes a mile, whilst the latter part of the distance, till the carriage again stopped for water, averaged one mile in five minutes. Frequently the men were obliged to use any kind of water they could get; some being filled with duck-weed, straw, and filth of every description, which, of course, very much retarded the generation of steam. The inconveniences arose in the present case chiefly from the loss of our tender, which would have carried us to Reading without any stoppage.

" All these delays would, of course, not happen, if water stations, having tanks with large hose, which might fill the carriage in a minute, were provided. There is no doubt, that had such arrangements been made for supplying the ' Erin' on the present journey, it would have performed it, including stoppages, in six hours ; though the carriage was not built, I am informed, nor intended for long journies, but for such short distances as between London and Paddington.

" Mr. Hancock started from Marlborough to return to London on Friday at half-past five. The carriage accomplished the ascent of Marlborough-hill—the steepest acclivity on the Bristol-road, being full one mile long, and having a rise of about one in twelve, in six minutes, with a stoppage of four minutes. The ' Erin' reached Reading by ten, and stayed one hour and a half for breakfast. After running through the town we continued our journey, and reached London by half-past five, being again twelve hours on the road, and having lost nearly about the same time in stoppages as on our journey down.

" Our reception on the road was very cordial ; there was scarcely any manifestation of bad feeling throughout the journey ; indeed, wherever we stopped to take in water, we had every assistance given us by the bystanders. We were particularly well received at Marlborough, where we stayed two days. The carriage made a trip through the town each day ; and Mr. Hancock astonished the inhabitants by the easy manner in which he could turn, stop, or back his carriage. Two gentlemen of Marlborough most hospitably entertained the steam travellers whilst they remained in that town.

"Subjoined, I give a table of the performances of the steam-carriage taken from the notes of the gentlemen who timed the carriage.

"And remain, yours truly,

"R.

"London, August 10, 1835."

TO MARLBOROUGH.	No. of Miles.	Miles from London.	Time.	Stoppages.	Time of Travelling exclusive of Stoppages.	Miles per Hour.
			h. m.	h. m.	h. m.	
London	0	0	6 27			
Hounslow	10	10	7 27	0 8	0 53	11 3
Maidenhead	16	26	9 37	0 41	1 29	10 8
Reading	13	39	11 11	0 13	1 21	9 6
Dine at Reading	—	—	—	1 20	—	—
			P.M.			
Newbury	17	56	3 11	0 54	1 46	9 6
Marlborough	19	75	6 23	0 50	2 22	8 0
Total	75		11 54	4 6	7 49	9 6
TO LONDON.						
Marlborough	0	75	5 32			
Newbury	19	56	8 12	0 52	1 48	10 6
Reading	17	39	10 10	0 19	1 39	10 3
Breakfast at Reading	—	—	—	1 30	—	—
			P.M.			
Maidenhead	13	26	1 31	0 46	1 5	12 2
Hounslow	16	10	4 10	0 30	2 9	7 4
London	10	0	5 30	0 25	0 55	10 9
Total	75		11 58	4 22	7 36	9 8

Shortly afterwards the "Erin" ran to Birmingham, at the desire of some capitalists who contemplated the formation of a company. The *Coventry Mercury* gave the following account of the journey:—

"JOURNEY FROM LONDON TO BIRMINGHAM.

"The London and Birmingham Steam-Coach Company, on Friday, August 28, started one of Mr. Walter Hancock's steam-carriages, in order to ascertain the power required for running steam-carriages (for carrying passengers) on the turnpike-road between the above-mentioned places; and also for the purpose of building carriages for the aforesaid line of road. The trips were made to the following towns, where the Commissioners of the several Trusts were assembled to view its performance; namely, Redbourn, Brickhill, Dunstable, Daventry, Coventry, and Birmingham. These experiments pointed out that an engine of greater power was required between London and Dunstable than would be necessary between Dunstable and Daventry, arising from the nature of the soil, and the materials of which the roads were composed; showing that a level road of inferior materials is more injurious to draught than a hilly road formed of good stone, and properly constructed. The greatest obstacles the carriage met with were—Ridge-hill and River-hill, between London and Dunstable—Hockcliff-hill, Denbigh Hall-hill, and Weedon-hill, between Dunstable and Daventry—and on the third station, between Daventry and Birmingham, the ascent at Ryton Toll-gate, and the entrance to the town of Birmingham. The engine with which these experiments were made, was built for short runs and a level road; and having performed the distance between London and Birmingham at the rate of ten miles an hour, it clearly demonstrates that engines of the same weight, and possessing double

power, (of which one or two are now built,) will maintain a speed of from 14 to 15 miles an hour throughout the journey. These carriages are intended to carry about twenty-five passengers each; the fares inside not to exceed 1*l.*, and outside 10*s*. It is expected the arrangements will be completed and the carriages ready to start by the beginning of March, 1836. The manner in which the carriages were received by the numerous crowds of people on the road was truly gratifying. We hear that it is the intention of the Company to employ the present coachmen and guards as directors of the steam-carriages."

Some circumstances occurring relative to the parties who had induced the writer to make and construct the drag or tug before referred to (p. 68) as having run to Reading, which he had much reason to complain of (the expenses of its alteration from a carriage, for which it was originally intended, to a drag, and other claims, remaining to this day unpaid), he altered and enlarged it into a carriage, with accommodation for eighteen passengers, (upwards of thirty have, on several occasions, been carried upon it,) to which he gave the name of the "AUTOMATON." It was brought out on the Paddington-road about the middle of July, 1836. Its performances will be found referred to hereafter.

On the 11th of May, 1836, the writer commenced a course of traffic on the Paddington-road, with the whole of his carriages, which he has continued, without the intermission of a day, up to nearly the present time. A statement of that traffic, in a letter to the Editor of the *Mechanics' Magazine* is subjoined.

"Sir, Tuesday evening, the 20th instant, completed twenty weeks' continued running on the Stratford, Islington, and Paddington roads, during this year, and I beg to hand you as faithful an account as I can of the performances of my carriages.

" Since the last notice in your Magazine, a new carriage, the ' Automaton,' has been brought upon the road, the only difference between which and those preceding it is, that the engines are of greater power (having cylinders of twelve inches diameter, whilst those of the others are of nine inches), and the carriage altogether of larger dimensions than the others, it having seats for twenty-two, whilst they are only calculated for fourteen passengers. It is an open carriage like the ' Infant ;' and although only calculated for the accommodation of twenty-two passengers, it has carried thirty at one time, and would then have surplus power to draw an omnibus or other carriage containing eighteen more passengers, without any material diminution of speed ; its general rate of travelling is from twelve to fifteen miles per hour. On one occasion it performed (when put upon the top of its speed, and loaded with twenty full-grown persons) a mile, on the Bow-road, at the rate of twenty-one miles per hour.

" The first time the ' Automaton' was brought upon the road (the latter end of July), it conveyed a party to Romford and back, at the rate of ten to twelve miles per hour, without the least interruption or deviation in its working, although it was the first, or as I may call it, the day of proving ; nor has it required any repairs whatever to this time.

" After this digression in describing the 'Automaton,' I will return to the actual work done on the public roads and streets of the metropolis during the last twenty weeks, or five months, in as concise a manner as I can :—

The miles run, about - - - - 4,200
Passengers carried - - - - 12,761
Trips—City to Islington, and back - 525
Do. - Paddington, do. - - 143
Do. - Stratford, do. - - - 44
Supposing the carriage had always been full,
the passengers carried would have been - 20,420
Average time a carriage has run each day—5 hours 17½ minutes.

" An exact account of the number of times that the carriages have gone through the City in their journeys has not been kept, but I should suppose that it must be more than 200. For the last five weeks a carriage has been at the Bank twice a day, viz. between the hours of two and three, and five and six in the afternoon.

" It was on one of the morning trips from Stratford to the Bank, through the City, that the steamer became entangled with a waggon at Aldgate; and which, I am happy to say, is the only accident worth recording. The shafts of the waggon were swung by the contact against the projecting front of a shop; the damage done was trifling, and occasioned by the wheels of the steam carriage having got into the iron gutter, and out of which it is not an easy thing to gain the fair surface of the street, with any ordinary carriage, in so confined a situation as that part of Aldgate in which the accident happened; and it should be observed, that this occurred in making way for another carriage passing at the time.

" I will now give you an account of all other accidents (which have all happened to the damage of the steamers

themselves), viz. the chain pulley of the 'Enterprise' once broke on the axletree; the same occurred once to the 'Infant,' which were permanently and immediately replaced by castings from the same pattern, with a greater thickness of metal, and which have since stood well.

"The severe test afforded by the state of the City-road, and onward to Paddington, caused these failures; for the pulleys had stood well on the roads for many miles.

"Another accident was a hind-wheel of the 'Erin' coming off in the New Street, near the Bank, on which occasion the carriage sunk only about eight or nine inches, in consequence of the frame-work of the machinery taking the ground; and so little was the coach thrown out of the level, that the inside passengers were surprised when informed that the wheel was off. The concluding accident was by the steerage chain of the 'Infant' being too slight, and breaking at Islington, when the carriage turning short round, with one of the fore-wheels against the curb, the wheel was broken. This wheel was an old one, of much slighter construction than I now make them.

"In the early part of the five months' running, the close-bodied carriages, 'Erin' and 'Enterprise,' were about equally employed—in the latter part, and to the present time, in consequence of the fine weather, the open carriages 'Infant' and 'Automaton' have been running.

"I have occasionally examined the boilers and engines of all the carriages, and found that the engines have, in most parts, actually improved, whilst the boilers and fire-places

have suffered a deterioration less than could have been expected, from the use they have undergone.

"It may be remarked, that both boilers and machinery are suspended on well-acting springs, and which accounts for the state of all the parts being so well preserved. Some of the boilers have been in use for two or three years.

"There have been consumed in the before-mentioned traffic, fifty-five chaldrons of coke, which is equal to seventy-six miles per chaldron, or about 2½d. per mile for fuel; but this on long journeys would be much reduced by the application of the moveable fire-place, patented by me about three years ago, as our greatest expenditure of coke, in these short journeys, is in lowering and again raising the fire.

"I cannot conclude without noticing, with gratitude, the general civility and attention which I have met with, and my pleasure in discovering that the antipathies which existed in the earlier part of my career are gradually subsiding, and that, in fact, I never now meet with incivility excepting with a few carters or draymen, who consider the introduction of steam-carriages as an infringement upon the old-established use of horse-flesh.

"Years of practice have now put all doubts of the economy, safety, and superiority of steam travelling on common roads at rest, when compared with horse travelling; and I have now in preparation calculations, founded upon actual practice, which, when published, will prove that steam-locomotion on common roads is not unworthy the attention of the capitalist, though the reverse has been disseminated rather widely of late by parties who do not desire that this branch of im-

provement should prosper against the interests of themselves.

"After twelve years of incessant labour in steam-locomotion,

"Your obedient servant,

"W. HANCOCK.

"Stratford, Sept. 22, 1836."

"Mr. Hancock," remarks the Editor upon this letter, "is now the only engineer with a steam-carriage on any road. Sir Charles Dance, Colonel Maceroni, Dr. Church, Messrs. Ogle, Summers, Squire, Russell, Redmund, Heaton, Maudsley, Frazer, and a host of others—where are they? Echo answers—'Where!' Strange to say, however, we see steam-carriage companies advertised, whose engineers have either never yet built a carriage, or whose carriages when built have never stirred out of the factory yard!"

During the last October the "Automaton" has taken several trips to Epping, by way of Hackney, Clapton, Woodford, Loughton, and the old road of Staple Hill. The following account of the first of these trips, on the 21st of October, is from the *Morning Herald* of the 25th:—

"STEAM-CARRIAGES ON COMMON ROADS.

"With the view of further testing the practicability of steam conveyance on common roads, Mr. Walter Hancock, accompanied by a party of gentlemen interested in mechanical inventions, started on Friday morning last in his steam-

carriage the 'Automaton,' from his station in the City-road, to Epping. This line of road was selected by Mr. Hancock on account of its being, for the distance, the most hilly and uneven out of the metropolis, as well as satisfying his friends that, even with this disadvantage, from the late improvements which he has introduced, that the carriage would perform, at least, ten miles an hour, and the result proved that he more than under-rated its power. On arriving at Woodford, Mr. Hancock stopped the carriage in front of the house of Mr. Rounding, the sign of the Horse and Groom, who kindly procured a fresh supply of water. After remaining nearly a quarter of an hour, Mr. Hancock again started at a rapid pace, and having ascended Buckhurst-hill at the rate of, at least, seven and a half miles an hour, entered Epping, amidst the loud cheers of some thousands who were collected in the town, it being market day, and created much astonishment among many of the country folk, who had never seen such a vehicle before, and who could not imagine how it was moved without horses. The party having remained for some time in Epping, returned to town, and the whole journey, notwithstanding the disadvantages before mentioned, was performed on the average of eleven and a half miles an hour. Among the party were two or three members of the Society of Friends, who, as well as all Quakers, took a very warm interest in the success and general application of this humane mode of conveyance, and they, as well as other gentlemen, expressed themselves highly pleased with this trip. The crowds along the road and different villages to see the carriage were immense."

The following is a list of the steam-carriages built by the writer in the order of their construction, and the number of persons they were respectively calculated to accommodate, exclusive of the steersman, engineer, and fireman :—

Experimental carriage - - - - -	4 outside
Infant - - (trunnion engines) -	10 outside
Ditto (enlarged with fixed engines)	14 outside
Era - - (Greenwich) - - - - -	16 inside, 2 out
Enterprise - - - - - - - - -	14 inside
Autopsy - - - - - - - - - -	9 inside, 5 out
Erin - - - - - - - - - - -	8 inside, 6 out
German Drag - - - - - - -	6 outside, exclusive of those accommodated in the separate carriages behind
Automaton - - - - - - - - -	22 ~~inside~~. *outside.*

All these carriages (except the drag, as has been before explained) are constructed to carry their passengers and machinery on the same wheels ; but on one occasion, while running on the Paddington-road, the Era was unexpectedly called upon to perform the duty of a drag. This was caused by a trifling accident which occurred to the Autopsy : a pin having escaped from a part of the machinery, the vehicle was brought to a dead stand on the road near St. Pancras. To avoid the necessity of re-adjustment on the public road, which, however, might (as was apparent after examination) have been very readily effected, the Era was brought to its assistance, and the Autopsy being attached, it was towed up Pentonville-hill at the rate of full five miles an hour, to the station

in the City-road, where, in half an hour, the defect was remedied. The following account of the accident is from the papers of the day :—

" As Mr. Hancock's steam-carriage, Autopsy, was proceeding as usual yesterday morning to Paddington, a little beyond the Regent's-park, the carriage was in a moment brought to a dead stand. As no derangement could be discovered in any of the exposed parts of the machinery, and as most of the passengers had before been put down, he decided on making no further examination on the road; but as he wished to try the power of his last new carriage, the Era, he determined on taking the Autopsy in tow of the Era back to the station in the City-road. The latter was soon on the spot, the former attached to it, and the carriages moved off in company; but the ascent of Pentonville-hill (nearly half a mile long, and rising one in twenty at the steepest part) was the point of greatest interest; however, the hill was ascended half way with ease, when the slow motion was put on, and the two carriages cleared it without any further stoppage. When it is considered that the two carriages could not weigh much short of seven tons, besides 14 or 16 persons on them, making nearly eight tons, there can no longer be any question that hills will form no formidable obstruction to these carriages—especially as the hill is in a bad state, and the road exceedingly heavy. The stoppage of the Autopsy was occasioned simply by the key in the rod of one of the slide-valves within the steam-box shaking out; this was replaced, and the Autopsy started again in the afternoon at the usual hour."

It has never been the practice of the writer to over-rate

the capabilities of his carriages, as such a course could have ended only in disappointment both to himself and the public. He was, indeed, himself in some degree unprepared for the decidedly successful issue of the last-mentioned experiment. The weight of the carriage to be drawn, with its machinery, was not less than three tons, and the part of the road where the casualty occurred was for some distance unusually bad; the result therefore was not less strikingly illustrative of the power and efficiency of the machinery, than it was gratifying to the writer. As most persons connected with the metropolis are acquainted with the road between the City and Paddington, it will be unnecessary to enumerate the many difficulties connected with working a steam-carriage on that particular line, and he adverts to them here merely for the purpose of protecting himself from a possible imputation of having selected one that offered peculiar facilities for the undertaking; it is in fact, on the contrary, beyond question the least desirable for such a purpose of any of the roads in the vicinity of London, and over which no other carriages but his have ever yet been propelled by steam.

Considering the severe tests to which these recently-constructed carriages have been subjected, it affords the writer especial satisfaction to reflect, that not the slightest injury has ever been sustained by a single individual of the many thousands who availed themselves of them as a means of conveyance; and that during the entire period of their running only two accidents occurred to the Era, in both cases resulting from the same cause, and that simply the breaking of the crank-shaft, which had been made too slight. It has

been one of the principal problems in steam locomotion to determine the precise strength necessary to the several parts, to guard against *all* casualties arising from defective roads, or other circumstances, and without adding unnecessary weight to the carriage.

The only failures in the Autopsy have been already adverted to. In each of the cases the repairs were effected so promptly, that the public suffered no disappointment from a cessation of the working.

The estimate, on the next page, of expenses and wear and tear has been calculated, from the actual working of the writer's steam-carriages during their running for hire on common roads, but principally from the "Automaton," this carriage being the only one he has hitherto built of sufficient magnitude to cope with the ordinary contingencies always to be found on a long line of road. To this estimate the writer has added another, showing the outlay necessary for an establishment on a large scale, and the probable pecuniary results.

ONE DAY'S WORK, OR ONE HUNDRED MILES.

Expenditure.	£	s.	d.
Coke, 1*s.* per mile	5	0	0
Repairs, and wear and tear	4	0	0
Oil, hemp, &c.	0	10	0
Two engineers, two steersmen, two stokers, one guard	2	0	0
Rent of stations and offices, wages of attendants, &c.	3	0	0
Tolls	1	10	0
Fund for renewal of carriages, £2 each	4	0	0
Contingencies	2	0	0
	22	0	0
Daily profit	10	9	4
	£32	9	4

Revenue.	£	s.	d.
Fifty passengers, 1½*d.* per mile each	31	5	0
One ton of goods, 1*d.* per cwt. per mile	9	6	8
	40	11	8
Deduct 20 per cent. for light loads	8	2	4
	£32	9	4

ONE DAY'S WORK, OR ONE THOUSAND MILES.

	£	s.	d.
Say 80 steam-carriages, £1,500 each	120,000	0	0
— 50 common carriages, £120 each	6,000	0	0
— Stations, &c.	14,000	0	0
	£140,000	0	0

	£	s.	d.
313 working days, at £10 9*s.* 4*d.* per 100 miles, is for 1000 miles	32,760	0	0

Profit on Capital, nearly 25 per cent.

VARIOUS

STEAM-CARRIAGE IMPROVEMENTS.

During the course of his various experiments in steam locomotion, the writer invented and constructed many minor parts of the apparatus of a novel character, which are not noticed in the preceding descriptions of his arrangements. Among these the most important of them he considers to be his WEDGE WHEELS.

The following description of these wheels was inserted in the *Mechanics' Magazine* of the 8th of February, 1834.

"IMPROVED WEDGE-WHEELS.

"Sir,—I forward you a sketch and description of the wedge-wheels which I have adopted for my steam-carriages, having found those of other constructions insufficient for the purpose. Being desirous of employing vertical wheels, and knowing that those on the common plan could not stand in this position, I determined on trying a pair constructed in the manner I am about to describe, and which description I am induced to send you, from a belief they may be useful generally, and more particularly to those who are engaged in similar pursuits with myself.

" Fig. 1 is a front view of a wheel, with the front bind-plate removed, to show the meeting of the wedged spokes,

Fig. 1.

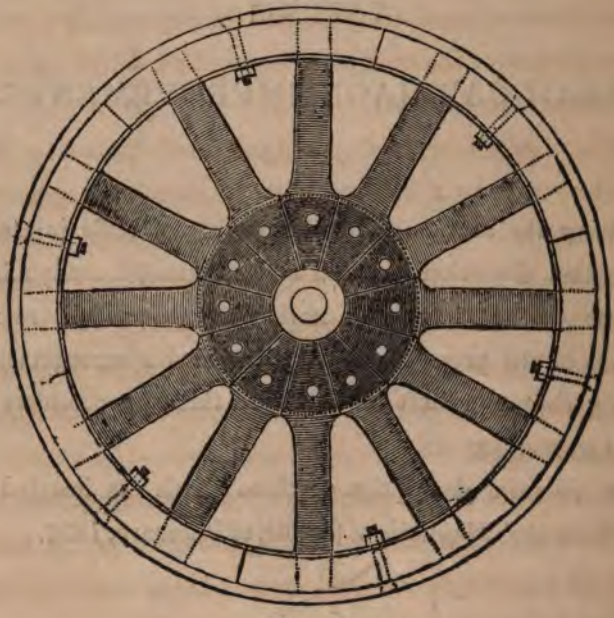


Fig. 2.

Fig. 3

which are of straight-grained, well-seasoned ash, tennoned into the felloes as in common wheels, but the nave ends are very accurately fitted to each other in radial joints butting against the iron box of the axle, and forming around it, to the circumference of the bind-plate (shown by a dotted circle), a solid connexion of timber.

" Fig. 2 is a horizontal central section of the above. The tire is secured by a bolt and nut, or rivets, through each felloe, the heads being countersunk, so as to stand flush with the outside of the tire. The box, which contains a reservoir for oil, is formed with its flange in one casting, the outside diameter of the flange being the same as that of the front bind-plate, which is like a large wrought-iron washer, and shown detached at fig. 3.

" Screw bolts pass through the back flange, spokes, and front bind-plate, the nuts turning against the face of which brace all together as one solid nave. There is one of these bolts on each spoke, as shown in figs. 1 and 3.

" The spokes throughout are of a parallel thickness, as shown in fig. 2, the edges being slightly rounded off.

" I have not entered into the details of the substance of metal and wood, as this must necessarily depend upon the size of the wheel, as well as the work it is required to perform. Having worked many such wheels on my carriages, I can say, from experience, that they are all that can be required in a wheel; they combine permanent strength with comparative lightness, and are by no means expensive in their first cost.

" I am, Sir, yours, &c.

" Walter Hancock.

" Stratford, Essex, Jan. 1834.

"P.S.—The Infant has a set of *dished* wheels on this principle, now in good condition, after having performed work which would have worn out two or three sets of wheels on the common construction."

Over the fore wheels are guards or fenders to protect the body of the carriage in the event of any accidental collision with another vehicle or other body.

Two strong iron bars are also attached in continuation of the front or platform steps, and approach to within a few inches of the road. These bars are intended as a precaution against danger, in the event of such an accident happening to the fore carriage as might occasion it to fall; they will also remove any obstruction from before the front wheels during the onward movement of the carriage. Stays of a similar description may also be advantageously attached to the hind axle.

In the early part of the writer's locomotive practice, the steerage or guidance of the carriage claimed a considerable portion of his attention; and the result has been the adoption of a chain working over two horizontal wheels, one on the centre of motion of the fore carriage, the other on the steering spindle.

This arrangement places the direction of the carriage under the complete control of the steersman; but, as some inconvenience might be experienced from the necessity of constantly employing the arms in keeping the carriage steadily in the line of its course, a friction-wheel and band was attached beneath the steering spindle, by which the course was held, and the arms relieved by the mere pressure of the foot upon a lever.

The mode of turning on or cutting off the steam; the best form of the clutches for connecting or disengaging the machinery from the propelling wheels; creating a draft of atmospheric air through the fire, first by means of a blower, afterwards by an exhauster at the top, and finally by returning to a blower of better proportions; the best kind of fire-place, and the check when going down hill;—all these and various other minute particulars have each in their turn occupied the writer's particular attention, with what success he freely leaves to any unprejudiced and competent inspector of his recently constructed carriages to decide.

It would occupy several pages, and render many additional engravings necessary, were the writer to enter upon an explanation of all the contrivances he has subjected to experiment during his locomotive pursuits; but as this would be levying too great a tax upon the reader's attention, he will conclude his narrative with a description of but one of them, viz. his patent furnace, &c. As the particulars of this invention were embodied in a communication to the *Mechanics' Magazine* of the 3rd November, 1833, he will merely give an abstract of that communication:—

"None but those practically acquainted with furnace-work can estimate the inconvenience and loss occasioned by a foul fire; nor is this drawback alike in the same furnace at different periods, but varying with the quality of the fuel, and other contingencies.

"I have been informed by good authority, that, on the late trip of Sir Charles Dance on the same road, the machine laboured under similar difficulties from the same cause, and

with equal diminution of speed, in certain distances, as the "Infant" did.

"Having, during the whole of my experiments on steam-locomotion for the last six years, had to combat this difficulty,

Fig. 1.

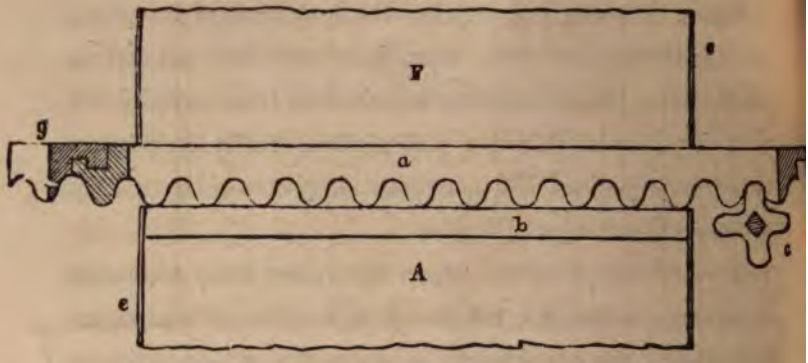
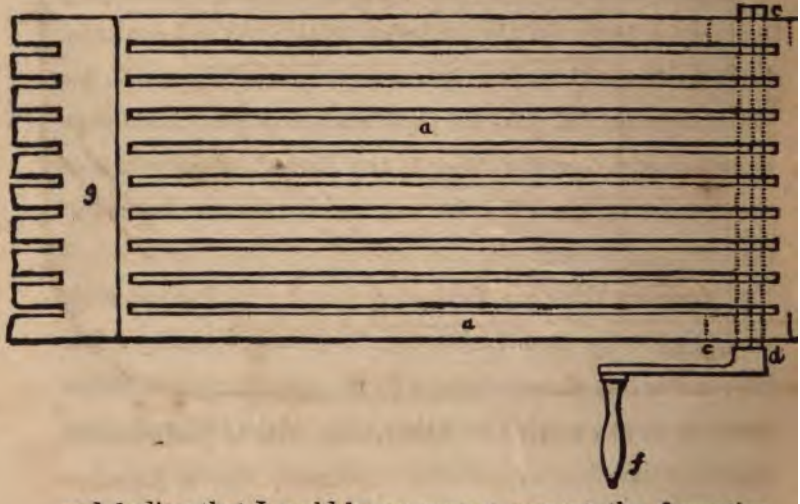


Fig. 2.



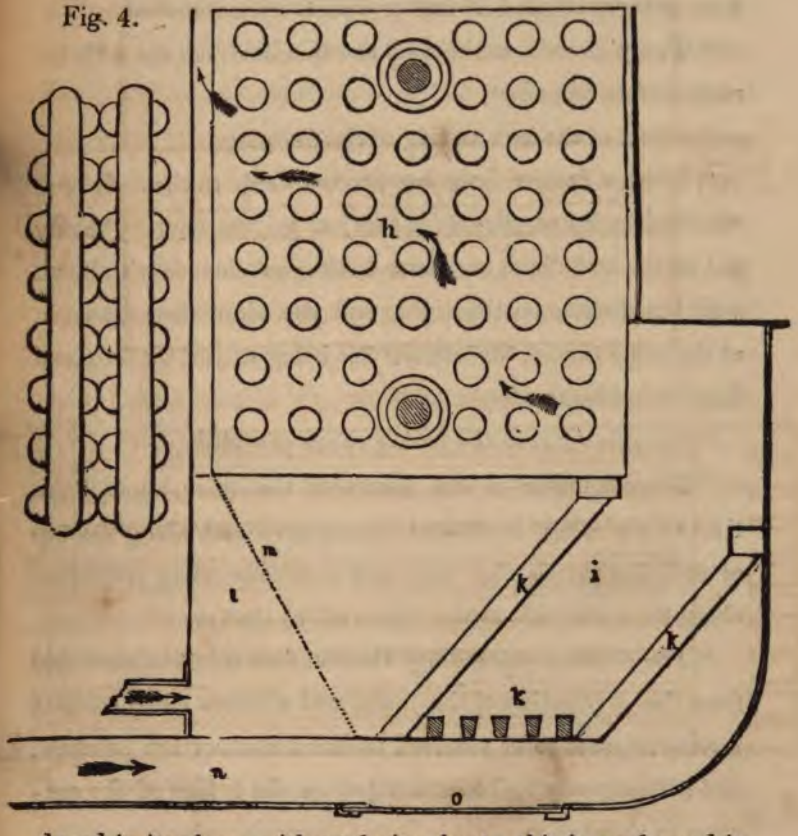
and finding that I could by no means prevent the formation of clinkers on the bars, I turned my mind to the invention of some mechanical contrivance, by which such an impediment *could be* readily removed. In this I have succeeded, and I

think it may impartially be deemed one of the greatest advances towards perfection in steam locomotion.

" By this invention, which I have recently patented, a foul set or floor of bars is readily taken out, and a clean floor intro-

Fig. 3.

Fig. 4.



duced in its place, without losing heat; this is performed in much less time than is required to imperfectly clear by the rake.

" Fig. 1, in the annexed sketch, is a vertical section of the furnace, and fig. 2, a plan of the same. F is the fire-place; A the ash-pit.

"*a*, is a floor of bars in one casting, in their position for use; the outer bars, on each side, are cast with teeth underneath, forming racks.

"There is a fixed rail under each rack, one of which is seen at *b*. These support the racks, and consequently the whole floor of bars, whether at rest or whilst being removed.

"Two pinions *c*, working on one spindle *d*, engage with the racks before named.

"*e*, part of the iron casing of the fire-place.

"When a floor of bars has become foul, a clean floor is attached to it, as shown (in part) at *g*; the winch *f* being put on the spindle *d*, and turned, the foul floor is withdrawn with the clinkers on the right, and the clean floor drawn in at the same time at the left, the fire being pushed on the clean floor as it advances.

"Suitable doors in the casing *e*, are provided.

"The connexion of one floor with the other, during the time of replacing, is effected by a groove cast along the top of each floor at the left end, and a corresponding projection along the under side at the right end, as shown.

"The carriage proceeding, the foul floor is left behind, and from the contraction of the metal and clinkers when cold, it merely requires to be reversed to divest itself of the clinkers, and is then ready to be exchanged on the return of the carriage to the station.

"This contrivance is not costly, it involves no practical difficulty, is accompanied by a material saving of fuel, and removes what has hitherto been a great obstacle to steam locomotion.

"I used to construct my boilers with partitions or flues between the chambers, formed of vertical bars of iron, framed edgeways like a grating, by which the chambers are kept a proper distance apart for the action of the fire; but I now prefer embossing the metal of which the chambers are made from the inside, and thus do without those partitions.

"In fig. 3, *h* shows the sides of a chamber of this description; and fig. 4 a front view of two such chambers; and it will readily be perceived that the hemispherical projections, or embossings, meeting in horizontal as well as vertical rows, I can either have my fire under the chambers as usual, the flame rising vertically only, or I can have it in front, the flame then acting horizontally, as well as vertically, as shown by the arrows; or I can have the front of the fire-place inclined, as shown in fig. 3: an arrangement which has its advantages, particularly in feeding the fire.

"In fig. 3, *h* is a chamber; *i* the fire-place; *k* the fire-bars, which are either of solid metal, or of tubes connected with the boiler, or for waste steam to pass through, to prevent their burning out; *l* the waste steam chamber; the steam blowing through the perforated division *m*, into the fire, is decomposed into its constituent gases; *n* the tube conveying air from the blower to the fire; *o* is a slide door, by which the whole of the fire could be discharged in an instant, whenever required.

"I am, Sir,

"Your obedient servant,

"W. HANCOCK.

"Stratford, Essex, October 17, 1833."

July 4th, 1838.

The preceding sheets were printed nearly two years ago; since that time I have brought out the Steam Phaëton shown in the title page, intended for my private use; it has seats for three persons, independent of the one steering. It has run principally in the City, and upon the roads in the east of London; but, within the last few days, I have occasionally run it in several parts of the west end of the town, principally in Hyde Park, amongst the throng of carriages and horses which are always to be found there on fine afternoons at this period of the year. Of course it did not fail of attracting notice, and as there was no noise, nor any appearance of steam, fire, or smoke, I was gratified to witness the general expression of approbation, as well as particular inquiries of several noblemen and gentlemen, some of whom were pleased to request a ride with me.

I have, with this carriage, gone at the rate of twenty miles an hour, but its usual rate is not more than from ten to twelve. My object in building it was to demonstrate, that my boiler is applicable to the propulsion of carriages for actual use on common roads, of any and every degree of power; and I am now engaged in applying this boiler to a locomotive engine for a railway train, from which I confidently anticipate very considerable advantages to arise.

W. H.

APPENDIX.

The facts of the case in regard to the "London and Paddington Steam Carriage Company" are simply as follow:—The engagements entered into with this Company have already been narrated, —shortly after the commencement of the running of the "Enterprise," the writer ascertained that the self-stiled "projector" of the Company, had (with the knowledge of a little clique of his among the subscribers), *for some months been engaged in building a steam carriage himself;* this carriage, when it came to be seen, was found *in its general arrangements, and in the strength and proportion of its parts—a copy of the "Enterprise;"* the principal difference, and the cause of its failure, consisting chiefly in the boiler, which, being secured by patent, the "projector" could not adopt; to get over this difficulty he took out a patent for an imitation or piracy of part of the writer's boiler. The whole of this project, however, met with the fate it deserved, in a total and complete failure, alike disgraceful to the morals as to the pretensions of the parties concerned. The following is the letter alluded to in the "Narrative:"—

Stratford, November 4th, 1833.

TO THE DIRECTORS OF THE LONDON AND PADDINGTON STEAM-CARRIAGE COMPANY.

Gentlemen,—I am perfectly surprised at a communication which I have received from you, dated 29th October; the alteration of your intentions and propositions from time to time, but to which, nevertheless, I was desirous of acceding, if possible, is so very

unlike business, that I must beg to inquire whether your letter of the 28th ult. is one upon which you intend to act; as it is so totally at variance with the negociation at this time pending between us, and is not in the remotest degree an answer to my last letter, written to you on the subject of the "Enterprise" Steam Carriage.

But I take leave to point out to the Directors, and through them to the Company, the course which the proceedings have taken; and at the same time apologize for the length of my communication.

When the "Enterprise" ceased running, early in the month of May last, I undertook, at my own expense, to remove it to my own premises at Stratford, examine and revise it throughout, and return it to the Directors after such examinations; although I did not admit that it was not in a state for work, as it performed more work on the day it ceased to run, than on any other day.

I subsequently found that your engineer took it out, *without my knowledge*, and that damage occurred to it, (whether by accident, incompetency, or design, I will not stop to inquire); after the damage had been so done, several men were employed upon it, under the direction of your engineer. With such proceedings I thought I had reason to be dissatisfied. Feeling, however, how injuriously any long-continued absence of the carriage from the road would act upon the mutual interests of myself and the Company, I requested an interview with the Directors, and remonstrated with them, referring them to my letter of the day before, of my readiness immediately to attend to the carriage; taking an opportunity to express my desire to alter the fire-place, and my wish to take it home for that purpose.

To this the Directors consented, but on my applying for it, your engineer refused to deliver it to me; your engineer also wrote me a note to such effect, on the 16th of May.

On the 17th I wrote an appeal to the Directors, to which they replied on the 18th by stating, that their responsibility for the *safe custody* of the carriage, unauthorized as they were to part with it even for a few days, would render *securities* necessary before they could allow it to be removed.

The application for securities, therefore, emanated from the Directors.

I wrote to them the same day, consenting to give such securities as they might require.

On the 20th I received another communication, in which a totally different objection was made—that the return of the carriage to my premises would impair the confidence of the public! To this I replied very fully on the 21st, and complained of the uncalled-for interference of your engineer. On the 23rd a number of interrogations were put to me, to which I replied fully on the 25th. On the 19th of June I wrote to the Directors, requesting payment of the balance due on the last instalment, and requesting some information as to the prospects of the Company, &c. On the 25th I received for answer to the first part of my letter, requesting payment of the balance due to me—that they employed an engineer to inspect the work in the carriage, and his report did not warrant a compliance with my request; and that "as to my other queries, they did not know of any ground on which I was authorized to make them." Knowing, as of course I did, that the carriage had been three months painting on the premises of your engineer; had been running for hire more than a fortnight; had been taken on the road by your engineer; and had been then, altogether, six months in your possession: this appeared very strange. However, on the 8th of July, I wrote for a copy of the report of the engineer you had employed, but to which you returned me no answer; at length, a meeting of the proprietors was called, after which, on the 20th, I received a letter from you, inquiring if I would, on the carriage being put into my hands, give ample security, that on delivery, it should be in a state to stand a full day's work of fourteen consecutive hours, on the London and Paddington road! This was quite new, both as a proposition, and in point of fact. I had never contracted for any thing of the kind, and no steam carriage had ever yet done such a day's work; besides, the security is not now demanded on the ground of responsibility for its safe custody, but for its performance: however, I again offered to repair the carriage and give security for its re-delivery, within a specified time, without expense to the Company; and again, on the 1st of August, I made a formal proposition to the Directors, and I studied to make it in terms so fair and unobjectionable that the matter might, with certainty, be

brought to a close. I must beg to refer you to it for reconsideration.

On the 8th you propose, that I should pay 1000*l.* into the hands of bankers, (not for the safe custody but) as a penalty, to be forfeited if I failed to *perform the stipulations of a memorandum which I had never seen!* On the 10th, I sent to the Directors a copy of such an engagement as I would find competent persons to sign, and to which I again refer you. On the 13th, you ask for the names of the parties—you then require reference, which being furnished, you signify your approval.

I now thought every obstacle was removed; but you replied that the securities must be in the form of bonds, and that I must pay the expenses of them; to which I, of course, objected, conceiving that a written engagement, on the part of two respectable persons, was a sufficient guarantee for the re-delivery of the carriage; and that if any other was required, the party requiring it should pay the costs.

In your next you tell me, that unless I comply by a certain day you would have a fresh survey of the carriage made, put it into some other person's hands, and seek to recover the expense by proceedings, to be instituted against the former securities. On my stating, once more, that my securities were ready (for the re-delivery of the carriage), and myself still willing to examine and revise it without expense to the Company; inquiring at the same time what could induce you to put the carriage into other hands, and thereby incur unnecessary expense and litigation; but to this letter you make no reply, but serve me with a formal notice, that you now wish me to pay 960*l.* into the hands of a Mr. A. Booth, and take the carriage away forthwith. What I am to understand by such a series of proceedings I cannot tell, as they have been so constantly varied; besides, you have had the carriage long in your possession—you have given your receipt for it—you have rode in it, and expressed your satisfaction at its performance—based a Company upon it—took hire for it for more than a fortnight,—in fact, exercised all the rights of proprietorship, and paid the last instalment in part, only because your funds were not in a state to furnish the remainder,—and yet, after all this, you ask me to return you the money, and take back the carriage!

But let us take another view of this affair. On the 29th of April, and after the "Enterprise" had been running a week, your engineer addressed a letter to the shareholders, to which I respectfully beg to call your attention. This was not written by a person ignorant of the machine about which he wrote; he saw it built—he had it three months under his own roof—he had often been on it, and seen its performances, and extolled it,—nor was he altogether ignorant of the subject on which he spoke and wrote; and although his letter is indiscreet as to his anticipations, yet it is clear that having, both with regard to the build of the carriage and its performance, every opportunity of judging, he must either have been ignorant, as an engineer, or he must have written a deceptive description to those very persons whom he describes as having large claims upon his gratitude.*

I cannot conclude this letter without calling your attention to the manner in which the "Autopsy" steam carriage has been received on this road, and by the public almost universally, proving that, but for the strange and unfortunate management of this whole concern, with what facility the "Enterprise" might have been made to realize a considerable profit during the summer, by occasionally running it, and, what is of more importance, all the shares might undoubtedly have been sold, and the Company at this time enabled to have brought three carriages on the road; instead of

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* CIRCULAR FROM THE PROJECTOR AND ENGINEER TO THE SHAREHOLDERS OF THE LONDON AND PADDINGTON STEAM CARRIAGE COMPANY.

"SIR,—My early statements regarding the performance of our first carriage being proved by demonstration to be strictly correct, as the Projector of the Company, and having a strong and grateful feeling towards all who united themselves with me in the early stages of the Company's progress, and who, by the liberal construction which they all along have put on my endeavours, I feel I should grievously fail in what I consider is due to them if I delayed one moment longer in informing them, that I have not the least doubt the shares of the Company will increase in value gradually to 100*l.** per share, within twelve months from this period; and I am equally satisfied that, in the succeeding six months, they will increase to at least 200*l.* per share. As this thing is so clear to me, I feel that I should be injuring myself in the future good opinion of shareholders by withholding the information one moment longer.

"I remain, yours respectfully,

"D. REDMUND,

"Projector and Engineer to the Company.

"*April* 29, 1833."

* The original price of shares was 25*l.*

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